This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

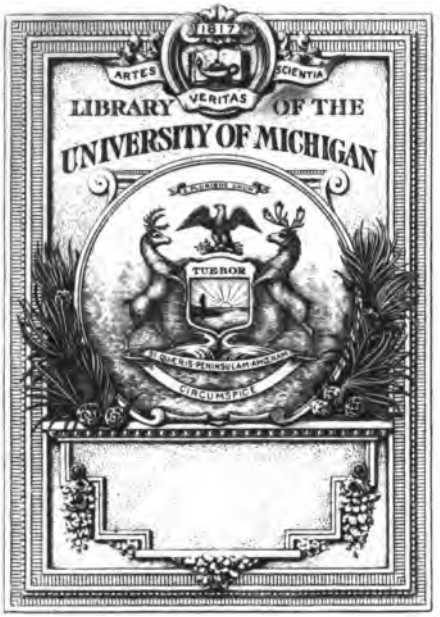
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



RECEIVED IN EXCHANGE
FROM
University of Michigan
Transportation Library

TN
403
.M5
S98
gal.

APPENDIX

—TO—

SWINEFORD'S HISTORY

602

—OF THE—

Lake Superior Iron District,

BEING A REVIEW OF ITS

MINES AND FURNACES FOR 1872.

MARQUETTE:
MINING JOURNAL OFFICE;
1872.

TN
403
.M5
S93
a.i U.

The Lake Superior Iron District.

ANNUAL REVIEW, 1872.

Since our last annual review of these mines there have been so many changes in leases, by sub-division of property, and such marked advancement in development, that we find it necessary to make a new classification of companies in order to locate the improvements under their proprietary headings.

THE NEGAUNEE HEMATITE RANGE.

consists, so far as developed, of the west half of section 8, and nearly all of section 7, of town 47, range 46. It lies adjoining and on the south of the village of Negaunee, and is occupied as follows: McComber mine 40 acres, Negaunee mine 160 acres, Green Bay Iron Company 160 acres, Allen mine 80 acres, Rolling Mill mine 80 acres, Himrod Hematite Company 80 acres, Spurr & Calhoun 40 acres, and a lease of four 40's held by Crocker, Shelden & Allen, on the southwest quarter of section 7, which, upon test, shows good deposits of ore. Added to these is the Grand Central mine of 96 acres, on the north, and the Iron Cliffs Company's Section Eighteen mine on the south, making in all ten companies at work, or ready to mine, seven of which have been shipping ore, and all of which have fifteen available openings. The deposit also extends back into the Jackson Company's property, on the west, but are not considered substantially of the range. This we will notice in our review of the Jackson mine.

THE QUALITY OF THE ORES.

Two years ago, it will be remembered, the lands which now compose the Negaunee Hematite range was a busy scene of exploration, the test pits and outcrops all over the location giving indication of inexhaustible beds of ore beneath. Subsequent developments proved that

every opening made disclosed large bodies of red and brown hematite, laid up as if once having been a pulpy mass of iron and being the pioneers were none too sanguine in their anticipations, for almost afterwards broken up in small, irregular nuggets, by seams and interseams, as the moisture was evaporated and the mass hardened. For the most part it is a soft hematite from 45 to 55 per cent. metallic iron, though here and there are found deposits of hard ore which will compare favorably with the specular. Again it is found in loose granular beds of a quality which will yield 60 per cent. of iron in the furnace. The foot and overhanging walls are generally of an iron slate, while in all the openings a large per cent. of magnesia is found near the surface, together with seams of spar and more or less loose drift; and the deposits seem to widen as they extend downward, dipping in an irregular direction, as if the iron lay in a mass beneath, and had been elevated on the surface in irregular ridges, leaving trenches which were filled with subsequent formation. The iron is found to be harder and cleaner as the depth of the mines are increased or as the work is carried back into a bank under the formation.

It would, indeed, be difficult to select one mine as being superior to another, as regards the quality of the ore, except in the variety of classification, for all of them present the same general characteristics, and with care in mining can be made to yield alike, as to value of product. Some of them, however, have decided advantages over others in point of location for the convenience or economy of working. The leading features of each will be mentioned as we proceed with our review.

THE RAILWAY CONNECTIONS.

The Peninsula Division of the Chicago & Northwestern Railroad is located along the east line of the range, through the Allen and Ada lease, and runs thence westwardly in close proximity to the north end of the Green Bay Company's lease, the Negaunee, the Grand Central and the McComber mines. A branch has been run southwest to the Cliffs Section Eighteen from the centre of the east of the range, one to the Allen mine, one to the Green Bay mine, and another from the main line, near Negaunee, which is to tap the Rolling Mill, the Himrod Hematite and the Calhoun & Spurr—so that with but short branches every opening on the range can be accommodated fully and completely with transportation.

THE IRON CLIFFS COMPANY SECTION EIGHTEEN MINE

Is owned by the Iron Cliffs Company, and is the most southerly opening so far made on the range. It is located near the southerly centre of the range, on a part of many thousands of acres of lands belonging to the same company which will be noticed in detail in proper place. The ore taken from this opening assays from 52 to 58 per cent. It is mainly of the soft, red order, and lies in mass at such elevation as to be easily taken out,

and carried a short distance to a dock for shipment. The improvements made this season for handling the ore consist of a switch and side-track, connecting the mine with the Peninsula Division of the Chicago and Northwestern Railroad. There have been shipped this season about 700 tons, but there are mined and ready for shipment not less than 8,000 tons, the most of which would have been sent off if transportation had been furnished to carry it. The company have arranged to mine next year about 20,000 tons, and are promised transportation to deliver it to their customers.

CALHOUN AND SPURR MINE.

This is 40 acres on the south-east corner of section 7. Messrs. Jno. L. Spurr and Wm. Calhoun leased the tract of Edward Breitung, in the spring of the present season, and in September commenced stripping preparatory to taking out the ore. They have stripped nearly an acre, and exposed a fine body of ore on the entire space, lying against a bluff which runs up upon the forty west of it. But two and three feet of soil was taken off, and from the appearance of the deposit there seems to be a face of not less than fifteen feet at the highest point stripped, while the test pits higher up the bluff show a continuation of the deposit, with every indication of good depth.

The ore is a rich brown soft hematite, with here and there a seam or pocket of dark, hard specular, and a considerable quantity of hard hematite — remarkably clean throughout the whole deposit so far uncovered.

Negotiations have been pending for the sale of this lease to eastern parties, who desire to work it for their own furnaces, but up to this time the sale has not been concluded. Should it not take place the present owners will work it next season, and take out from ten to fifteen thousand tons of ore.

HIMROD HEMATITE COMPANY.

The lease of this property, 80 acres, north of the Calhoun & Spurr, was effected in July, and the company was organized on the 27th of the same month, by the selection of the following officers: Thos. B. Brooks, Marquette, President; A. P. Cornell, Youngstown, O., Secretary and Treasurer; J. L. Orthey, Negaunee, Superintendent. The owners are, the Himrod Furnace Company, Youngstown, O.; A. Wright and Robt. Kelly, New York; C. C. Eddy, Thos. Heard, Negaunee, together with the gentlemen named as officers. Active preparations for mining were immediately engaged in, and the location is now stripped for work to a considerable extent. A cut has been made from a level on which a switch is to be built to bring in cars. The wall of this cut is 52 feet high at its extreme rear point, where it strikes a face of ore of the same height. It passes through the hematite peculiar to the range, and a quantity of hard silicious ore, and gives such access to the bank as will

enable the company to take out all the ore in the bank on the right and left, and work upon the interior face at the same time.

This deposit is regarded as a fair representation of the quality and extent of the ore of this range. The property—consisting of two 40-acres, the second lot being in the rear and higher than the first upon which the opening is made—is most advantageously located for rapid and economical working, as nothing is required but ordinary hand quarrying to transfer the ore from the bank to the cars. Docks are to be built, and from eight to ten thousand tons of ore are to be put in stock this winter. It is now expected that not less than 50,000 tons will be shipped from this mine next season.

THE GRAND CENTRAL.

This leasehold is the property of I. S. Waterman, Philadelphia, and S. S. Burt, Marquette. It is on a 96-acre tract, occupying the space between the Chicago & Northwestern Railroad and the McComber mine, and has been worked since the summer of 1870. This season 10,000 tons of ore were shipped from it, leaving 2,000 tons in stock, and about the same amount, belonging to the same firm, on the Allen location, where they had formerly operated. The ore has been shipped to leading iron companies in Buffalo and Cleveland, who are desirous of renewing contracts for next season. It is intended to strip, during the winter, so as to widen the cut which leads to the main body about 30 feet, and also to uncover the vein some 200 feet further in length, and thereby materially enlarge the working faces in each direction to have the mine ready for taking out from twenty to thirty thousand tons next season with ease.

THE ADA MINE.

This consists of 40 acres north of the Allen lease and east of the north 40 of the Green Bay Iron Company. It was leased of the Negaunee Company—Lonstorf & Maas—in October last, by Samuel Carter and P. Meagher. Grading has been made for a side track, and a cut made to reach a good face of ore. About 1,000 tons of ore were taken out in the process of making the cut, and preparations are now making to ship about 10,000 tons next season.

THE GREEN BAY IRON COMPANY.

This company consists of W. C. Pettibone, President, H.H. Albright, Secretary and Treasurer, and L. J. Day, Superintendent—all of Green Bay, Wis. The property consists of the west half of the west half of section 8, 160 acres. It was leased of Harriman & Spurr on the 11th of September last, and the mine on it has been known as the Harriman mine. There are three openings on the north quarter of the property which were made in the spring of this year, and from which about 7,000 tons of ore have been shipped up to this time, while there is some

4,000 tons in the stock pile. The new company take hold of the work very vigorously, and propose doing quite an amount of stripping during the winter, and to build a second branch track to lead to the Chicago & Northwestern Railroad, and one to connect with the Marquette, Houghton & Ontonagon Railroad, besides constructing boarding-houses, barns, stock and shipping docks, and making sundry other improvements, to enable them to work the mine to its full capacity next season.

The ore, like most of the range, is the red and brown hematite, with a considerable quantity of silicious ore. That ore exists in large quantities on the remaining portion of the lease has been determined by explorations, and the mines on both sides of it. Other openings will doubtless be made next season.

THE NEGAUNEE MINE

The proprietors of the Negaunee Mining Company are Messrs. Lonstorf & Maas, and their lease consists of half of the northeast quarter and the east half of the northwest quarter of section 7. An opening was made in the south half of the east half of the northwest quarter in the season of 1871, and a considerable quantity of ore taken out, but owing to the absence of railroad facilities for taking the ore away from the mine the work was suspended. Work was then commenced, in March last, on the east half of the north half of the northeast quarter—at a point nearly opposite the Pioneer furnaces. A large and fine deposit of red hematite was found, forming a vein more than thirty feet wide, which has been worked over the surface to a depth of some twenty feet, the opening running back at an angle conforming to the gradual rise of the surface, some two hundred feet, and from which 9,000 tons of ore has been shipped, leaving over 1,000 tons in stock. Three shallow cuts were made at different elevations, to reach the different points of the incline upon which the mining is being done, and the ore was brought out and loaded on cars on a switch of the Chicago & Northwestern Railway, but a short distance from the mine. Work has been suspended for the present, but it is intended to resume before the close of winter. Meanwhile a track is being laid down which will run directly into the mine, and the whole face of the opening so far made will be worked into from the bottom of the same level. This track is also to be so arranged as to take in empty cars from one side and deliver them loaded on the other. There is a considerable proportion of hard hematite in this mine with the soft red oxide prevailing.

THE ALLEN MINE.

This property is comprised in 80 acres, 40 acres of the south-east quarter of the north-west quarter, and 40 acres of the north-east quarter of section 8. The company is comprised of M. H. Crocker, Wm. Allen and G. C. Shelden, of Negaunee. The lease was given by Ed-

ward Breitung, early in the season. Work was commenced in March, but progress was delayed until July on account of the absence of a railroad connection. A track having been laid, the first train of ore was shipped on the 17th of July, and the work has since gone on uninterruptedly, and over 8,000 tons of ore have been so far sent to market. The opening is a very advantageous one, being made at the foot of a bluff, on a level with and but a few feet from the loading docks, and the ore is of a very clean and uniform character, of the black manganeseous order, usually denominated hard hematite. The mining has been conducted upon strictly practical principles, and the main opening is being worked on a face thirty feet high by three hundred feet long—all intermixture of earth, rock, &c., having been removed to work directly upon this broad face. Meanwhile stripping has been going on, so that the limit to the amount of ore which can be taken out is only dependent upon the number of men put to work.

Besides this work, on the west side of the property, four openings have been made on the east side, which disclose an abundance of ore and from which quite a quantity has been taken.

A little distance west of the main, or first opening, and across a ravine, a bed of hard silicious ore has been opened and a considerable quantity of it taken out. This also lies in a most advantageous position for cheap and rapid mining. In short the property is one of the best, if not the best, on the range, in point of exterior convenience for working, the ore lying at an elevation and the railway grades at its base.

The shipments so far this season have been about 8,000 tons, and if transportation could have been supplied the amount could easily have been doubled. It is intended, if possible, to take out and ship, next season, 50,000 tons. A force of men will be kept on the work during the winter, and it is intended to build another railroad track to the mine so as to be able to bring in empty cars without waiting for loaded cars to be taken away. A shaft will also be sunk to the depth of fifty feet from the level of No. 1 opening, to test the depth and quality of the ore below the present working level.

The mine claims to have made considerable money since being opened, and this is more than is usually expected of a new mine, during the first year's operations. Besides the working improvements made there have also been six boarding houses erected, a barn, store house, blacksmith shop, dry house, an office, &c.

CROCKER & SHELDON'S LEASES.

Messrs. Crocker & Sheldon have leases of the three "forties" on the south boundary of section 7, west of the Calhoun & Spurr, and the "forty" adjoining and north of the centre one of these three. Explorations on this property have been made to a large extent, developing what is supposed to be a large and valuable deposit of hard hematite. A

trench has been made for a distance of sixty feet up the bluff on the face of the lower plat, through a deposit of good ore. At the upper extremity of the trench a shaft has been sunk to a depth of 12 feet in the ore. Test pits have been made on both sides of this trench, and ore found in each case. An analysis of the average of the ore found at these different points was made and the result showed 52 per cent. of metallic iron. If this property is not sub-leased during the winter the present leaseholders will work it next season, and take out from six to ten thousand tons of ore. Meanwhile explorations will be continued on the other three lots.

THE M'COMBER MINE.

The McComber Mine is the best representative of the nature of the Negaunee Hematite Range. It is the oldest mine of the group and has been worked the most extensively. It was opened in 1870 by Mr. Wm. C. McComber, and quite a quantity of ore taken out and shipped that year. In 1871 he took out and shipped over 17,000 tons. This ore reached two or three furnaces in the Marquette district, the Allen Furnace, at Sharpsville, Pa., and the Cleveland Iron Co's. works, at Cleveland, and seemed to meet their requirements exactly for mixing with the specular ores, causing a yield of from 56 to 60 per cent. of an excellent quality of clean No. 1 iron from the mixture. This season, in order to secure a continuance of this supply a few gentlemen interested in the Cleveland Company, in mining ore and manufacturing iron, secured the property and formed a company with the following officers: Samuel L. Mather, Cleveland, President and Treasurer, and Fred A. Morse, Cleveland, Secretary. The lease was made to this company in July last, and the work of taking out ore has been pushed with much vigor since that time. The shipments so far this season amount to 25,000 tons, leaving some 2,000 tons in stock. Many important improvements are in contemplation, for the purpose of supplying every facility possible for the economical and thorough working of the mine.

Buildings for the accommodation of an engine and hoisting machinery are to be erected, and four hoisting shafts are to be located at different points in the mine, to be conveniently operated from the engine house. Cable drums with friction gear will be used for hoisting, and each shaft will be supplied with sufficient pocket receiving capacity to obviate the necessity of waiting for cars or dumps when there may be any delay. A central drain shaft will be sunk to the depth of 150 feet, and supplied with the best of pumping machinery. Additional side-tracks, cars, &c., will be provided, and everything necessary to work the mine to its full capacity put in order for all the business which can be done next season.

THE ROLLING MILL MINE.

This is a 40-acre lot, the southwest quarter of the northeast quarter of section 7. It was leased by the Marquette and Pacific Rolling Mill

Company, Marquette, of A. L. Crawford, New Castle, Pa., in September 1871, and 236 tons of ore taken out of it that year. This ore was used in the furnaces of the company at Marquette, and found to answer their purpose admirably for mixture with specular and slate ores. During the winter following preparation was made to work the mine more extensively this season, and up to this time some 7,500 tons have been taken out since the commencement of operations in the spring. Of this ore 5,000 tons of it has been shipped abroad, and the balance of it has been used at the company's furnace at home. The mine is regarded as a remarkably good one. The ore lies in place, with a working face of thirty feet in height. The opening is in elipsoidal form, and will admit a large number of workmen with convenience. So far the ore has been hauled on wagons some distance to the shipping docks at the railroad, but a track, elsewhere referred to, has lately been completed which runs directly to the mine. The company have erected some of the best and most comfortable dwelling houses for their miners to be found in the entire district. Next season work will be pushed to greater extent than heretofore, and the product of the mine will be more than doubled.

THE SEDGWICK, HOPKINS & M'KENNA MINE.

This property, consisting of 40 acres, is situated about one mile and a half east of the Iron Cliffs furnaces on the main line of the C. & N. W. railway. The proprietors have a ten years' lease of the land, and have done considerable work on it this fall, enough to develop a large bed of fine dark hematite iron ore, largely mixed with magnesia. A side track will be run into the mine early in the spring, only about 60 rods being necessary. The owners expect to ship several thousand tons next season. The proprietors are Wm. Sedgwick, C. H. Hopkins, and John McKenna.

THE JACKSON IRON COMPANY.

Work has progressed during the year in these mines without any marked new features in the character of the ore obtained, but with very decided results and some radical changes in the general operation of the mines. The ores are of the specular, granular, and slate varieties, with also a considerable proportion of hard and soft hematite, the soft being obtained mainly from the South Side mine, which is on a continuation of the Negaunee range, heretofore noted in detail.

All the ores of these mines maintain the high distinction given to them for quality when they were first introduced to the ore consuming market, being remarkably free from sulphur, phosphorus, manganese, and other foreign substances, and having but a small per cent. of silica.

The facilities employed for working the mines are very complete, and the means of shipment embrace both the Peninsular Division of the Chicago & Northwestern Railroad, and the Marquette, Houghton &

Ontonagon Railroad, though the product is mainly carried over the former road to Escanaba for shipment.

THE SOUTH SIDE MINE

Is a new one, opened this year, on the south boundary of the company's tract, and nearly on a line due south from where the first Jackson opening was made in 1864. The ore obtained at this mine is a soft hematite, and is designated as South Side ore. It differs from the hematite obtained in other parts of the Company's mines by being a red oxide, laying in bank with a loose formation of earth and rock, and requiring considerable care to assort it well for shipment. The hematite obtained from the other mines of the company, where they are interspersed throughout the specular and granular ores, are harder and considerably cleaner, and do not lie in so large a body.

The first ore taken from the South Side mine was shipped in August last, and up to the present time 7,645 tons have been shipped, while about 1,000 tons remain in stock. The present railway facilities are found inadequate to a proper working of the mine, and a siding is to be extended diagonally from the east line of the company's tract to a point at the foot of a bluff where the deposit is located, where a working face of one hundred feet can be obtained, and thus take out next season not less than 20,000 tons of ore. An abundance of room will be given for mining operations and the most rigid regulation enforced in regard to the selecting of the ore.

NUMBER ONE MINE.

This mine is worked out, having narrowed down from a surface opening of 200 by 300 feet to a floor level, 80 feet deep, 10 feet wide by 75 feet long. It is as complete an exhaustion, without fins or legs leading off in any direction, as can be found. There is yet a considerable quantity of ore clinging to the side walls, which was not taken out clean as mining progressed, and which is now being taken out by small gangs of "scammers," who obtain from two to three hundred tons per party in a season, but aside from this the mine has been virtually abandoned.

NUMBER TWO MINE.

This mine, communicated with by a tunnel from No. 1 on the east, and having an exit tunnel at greater depth on the west, has been worked out on the first level, and through the main body of ore in a space 150 by nearly 500 feet, to a depth of 150 feet, where the deposit, on the northeast corner, contracts to a width of 25 feet, which has been worked into a depth of 30 feet. The ore from this mine is loaded down a shaft upon cars which are brought in through a tunnel, which is a branch of the main tunnel, located on a level with the shipping docks on the north side of the group of mines. This branch tunnel runs from this mine toward the main tunnel a distance of 1,200 feet in a northwesterly direc-

tion, tapping several ore pockets of greater or less magnitude, all of which have been worked this season.

NUMBER THREE MINE.

This is located east and south of No. 1. It has not been worked this season, owing to the fact that the ore has been exhausted down to a level with the grade of a tunnel through which it was taken out. It is to be supplied with hoisting machinery and other appliances by which mining can be resumed next season.

NUMBER FOUR MINE.

This is an opening on the west boundary of the group, and is reached by the main tunnel heretofore alluded to, which runs from this opening north 600 feet to the shipping docks on the company's C. and N. W. switch The vein here mined is 600 feet long, with irregular sides, averaging 30 feet in width, and dipping to the north. This vein has been mined to a depth of 150 feet. A skip road 200 feet long is being constructed, at an angle of 45 degrees, to raise the ore from the lower level and deposit it in a rock pocket, left in mining, which will hold 500 tons, and from which it is discharged into cars in the tunnel through which it is taken out. The machinery provided for this purpose is a pair of double engines, of 140-horse-power, formerly used at Nos. 1 and 2, with drums, cable, &c. As there are no indications of an early exhaustion of this deposit, it is intended to work it still deeper than now, and hence the particular object of the machinery. There are frequent deposits of ore on the north side of the vein, apparently as if a part of it, but extending considerable distance under the hanging wall and conforming to the dip of the formation; and it would seem as though it would take some years to get out all of this ore if there was any method of securing this hanging wall without being obliged to remove it. Capt. Merry informed us that he had partially concluded to work it hereafter on underground levels, instead of excavating fully as he went down.

MINE NUMBER FIVE,

On the east side of the branch tunnel, is to be provided with a shaft 60 feet deep, and a skip road, to take out a large body of ore lately found to extend to the east of the old work. A pump shaft is also to be sunk in this pit to drain this and some of the adjoining premises. Power to operate the hoisting shaft will be transmitted by wire rope, from the engine located over mine No. 4, and the ore will be given to cars in the branch tunnel.

MINE NUMBER SEVEN.

This opening, lying on the south side of the M., H. and O. Railroad, close to the business part of Negaunee, has been perseveringly worked during the season. It has reached a depth of 30 feet on the north side. and on the south half, a rock shelf, which was supposed to be the bot-

tom of the ore taken out of that side extends over the deeper deposit, the latter dipping southwardly from where it has been worked to its greatest depth. Further deposits are thought to lie in close proximity to this opening, and attempts will soon be made to reach them.

SOME NEW DISCOVERIES.

Some distance north of the present Jackson group, and near the main line of the C. & N. W. Railroad, a deposit of ore has been discovered, which is peculiar and interesting in formation. The discovery was made about a year since, and this season a space 30 by 100 feet has been strioped, revealing an unusually fine ore bed. A complete examination shows that a broad belt of ore lies in crescent form from north to south, with the base of the circle curving to the west, having on the northern extremity a face of 30 feet, and in the center, or at its base, where it crosses an elevation, a face of 100 feet. The rock within the circle on the east is jasper and that on the outside or west a quartzite. A shaft which has been sunk a considerable distance west of the deposit as indicated on the surface, shows that this lode of ore dips westwardly at an angle of perhaps 40 degrees, and that it is in all probability the finest deposit of ore remaining on the tract. Work for the development of this mine is to be pushed with great activity during the winter. A shaft is to be sunk some distance west of the point where the ore lies near the surface, and tunnels are to be driven into the main body where mining will be carried on. The ore will be elevated by means of a skip road and dumped upon cars on the track leading from the main tunnel heretofore referred to. This opening on the west, with the face which will be exposed on the north, will afford excellent opportunities for taking out the ore, and it is expected that from three to four thousand tons will be mined before the shipments of next season are commenced. The space cleaned off, and the test pits, show that the ore is remarkably clean, and that it comprises all the varieties heretofore found in all the other openings of the Jackson group—specular, granular, soft hematite and slate.

MISCELLANEOUS.

Several of the small openings of the group, hitherto worked, will be allowed to remain idle while the larger ones can be operated more conveniently and profitably. Yet not less than 100,000 tons of ore will be taken out next season. The machine shop has received several additions in the way of tools, and the blacksmith shop, horse barns and dwellings of the company are in the best condition.

There has been no change of officers or owners in the company since our last review. The work has prospered exceedingly well. Indeed the remarkable success which has attended the operations of this company, while it has been supplying the market with about 1,000,000 tons of iron ore, is as gratifying to the public as to its officers.

The following is a statement of the total product of the Jackson mine, from 1856 to 1872, inclusive:

Year.	Gross Tons.
1856	5,000
1857	14,000
1858	12,500
1859	10,500
1860	41,000
1861	13,000
1862	43,000
1863	61,000
1864	69,000
1865	55,000
1866	87,934
1867	126,390
1868	131,707
1869	128,245
1870	122,710
1871	132,297
1872	112,060
To which should be added ore furnished to local furnaces previous to 1856, about	25,000
Grand total	1,058,146

THE CASCADE DISTRICT.

There are embraced in this district the mines of the Cascade Iron Company, the mines of Hussy, Wells & Co., the Gribben mine, the Carr Iron Company, and the Bagaley and the Emma mines. These properties are so closely together, and the deposits of ore are so nearly alike, as of the same formation, that we can describe them best by grouping them under one general head. The property all comes within ranges 26 and 27, town 46 and 47, and its development is but the growth of a little more than one year, after active operations had been commenced by

THE CASCADE IRON COMPANY.

The property of this company consists of 3,120 acres, located on section 19, 20, 29, 30, 26 and 27, in ranges 26 and 27, town 46 and 47. The ore is of the granular, slate and hematite orders, or the micaceous specular and magnetic oxides, ranging from 60 to 66⅔ per cent. in richness, some of it yielding as high as 68 per cent. The deposit of granular ores, as shown by the openings already made, and the test pits which have been put down on the property, lies in crescent shape from west to east, with the center of the curve lying south. For the most part the elevations and outcrops are from fifty to two hundred feet above the base of mining and shipping levels, giving working faces in some instances two hundred feet in height, while the depressions show no variation in quantity or quality of the ore. At one point in the course of the crescent, a depression occurs where a branch of the Escanaba river falls some forty feet over an iron ledge, showing that the depth of the iron in the bluffs

on either side of the stream is in all probability not less than two hundred and fifty feet, including the elevation, and possibly considerably more. To the south of the ridge of this crescent another bluff of iron is located, like a bulwark in front of the main wall of a line of military fortifications.

The openings on the Cascade property now consists of Nos. 1, 2, 3, 4, 5, 6, and the West End mine.

THE FIRST OPENING

Was made at No. 4, on the east, in the summer of 1864, but not until a branch road was brought in, a distance of six miles, from the Chicago & Northwestern Railroad, in 1871, was there any effort made to take out ore. In September of that year operations were commenced at No. 4 for shipment, and some 4,300 tons were taken out and sent to market before the close of the season. This year 18,000 tons have been mined, the most of which has been shipped.

THE WEST END MINE

Was opened in November, 1871, and up to the present time 15,000 tons have been taken out of it. This is located on the northwest end of the range as it asserts its prominence in the beginning of the crescent elevation. The face is exposed to the height of from 50 to 60 feet, with a corresponding width, the side walls of the cut being of as good ore as that which has been taken out. Further along on the range, and beyond and over quite an elevation, an opening has been made for the purpose of driving back toward the West End mine.

Next, passing along the range, we come to the

SAW MILL, OR NUMBER SIX MINE,

Which was opened in May, 1872, and from which 4,000 tons of ore have been taken. This is a part of the face of a cross section of the range which was at some time cut through in such manner as to admit of the passage of a branch of the Menominee, before referred to, which, some feet below the level now being worked on No. 6, makes a leap of 40 feet over an iron ledge and forms as fine a water power as could be desired.

Here a saw mill is located, which some time before the iron was opened was used to cut lumber for market, but is now used exclusively for the preparation of lumber for the buildings which are going up in the Cascade settlement.

Crossing the stream we find a separation of the range in two prominent elevations, with a valley intervening, the elevation on the left running up the course of the stream for some distance, and that on the right forming the site of

THE EMMA MINE,

Leased of the Cascade Company, in which work was commenced in January last by James E. Clark & Co., the firm being James E. Clark, W. P. Logan and A. H. Logan, of Pittsburgh, and John P. Logan, of

Philadelphia, Mr. Clark acting as local agent and superintendent. The work done up to this time will not fall short of 15,000 tons of first and second class ores, much of which is yet in the stock piles awaiting transportation.

The mine is very handsomely located, being a ledge consisting of a succession of hard hematite and hard slate ores, lying back against the mountain into which they are working, at an angle of 60 degrees from the plane of the surface, with the highest termination at the greatest distance from a perpendicular of the working ground; and the ore is quite uniform in quality through the entire ledge. Not twenty per cent. of rock has been encountered so far. The ledge extends some three hundred and fifty feet along the face of the mountain, most of which has been uncovered, and its width will average two hundred feet, while the depth or further width is not known.

The leasehold of the Emma Company consists of 16⅝ acres on section 31. Active preparations are being made to lay down a track with a more suitable grade, and make such other improvements as will enable Mr. Clark to take out from 40,000 to 50,000 tons of ore next year.

Further along, on an average level with the face of the country, and where the first prominent depression occurs, Hussey, Wells & Co., of Pittsburgh, are making an opening on the south side of the valley, while opposite is the

BAGALEY MINE,

Or No. 3 of the Cascade property, leased to Bagaley & Wilcox, which was opened in the fall of 1871, and from which some six thousand tons of ore have been taken up to this time. The mine is fully as advantageously located for favorable working as the Emma, the ore lying in mass on the side of a bluff, from which it is taken without much blasting and without encountering any great amount of rock or other foreign matter. Work at this point is being pushed with a great deal of energy, and the mine will doubtless be made to yield next year a larger proportion of ore than any other in the group.

Next, on the same level, is

NO. FIVE CASCADE,

Which was opened in April, 1872, and from which 3,700 tons of ore have been taken. This is a good mine, near the junction of the railway track leading to the Bagaley and Emma with the main branch road.

Returning to the saw mill mine and passing up along the base of the north or inner ridge of the range, we first find mine No. 1, opened in March, 1872, and from which 4,000 tons of ore have been taken. This opening presents peculiar characteristics, furnishing some half dozen

qualities of ore, without the jasper rock which usually accompanies the hard ores, and with but very few silicious substances.

Then we next arrive at

NUMBER TWO, CASCADE,

Which was opened in March, 1872, and from which 8,000 tons have been taken. This is undoubtedly one of the finest iron mines yet opened in the Lake Superior country. It has a face which is capable of being worked to the height of 200 feet, while the breadth and depth is only limited by the amount of labor which may be expended in exposing it. Ore can be cut from the side of the mountain in just such masses as can be conveniently handled, and freighted directly to the cars, and the amount which can be taken out is only limited by the number of people employed to handle it.

Section 25 and 26 are hematite properties. Nothing has been done to develop them, further than has been thought necessary to establish their character as first class beyond a doubt. There are some 600 acres of it, with enough hematite on it to supply all the furnaces in the country for years, if it was vigorously worked.

The improvements in use by this company consist of six miles of branch railroad, connecting the mines with the Chicago and Northwestern Railroad, and three miles of additional track which connect the different mines with the branch; a locomotive, a saw mill, a number of dwelling houses, a store, and the blast furnace which is now being erected at Escanaba, and which we will describe further along.

The principal owners of this propeaty are Wm. Bagaley and Thos. Kirkpatrick, of Pittsburgh. Being aside from the course laid out and developed by the pioneer companies, and six miles in the most favorable direction, from the railroad line leading to Escanaba shipping port, and between three and four miles from the Marquette line, a great expenditure of capital and labor was necessary to place the property, so far as shipping facilities were concerned, on an equal footing with its competitors. But all these points have been so arranged that the Cascade Iron Company is now a power within itself.

THE HUSSEY MINE.

Between the Saw Mill mine and No. 2 of the Cascade, on the north and inner side of the crescent of ore, is the Hussey mine, which is being energetically worked. There are nearly 2,000 tons of ore ready for shipment, and complete preparation is made for a large business next year.

The same owners have been prospecting on a lot east of the Emma, and south of the Bagaley, which promises to result in the development of a good body of ore.

THE GRIBBEN IRON COMPANY.

This company was organized during the spring of this season, with a capital stock of $500,000, on a basis of 20,000 shares at $25 each. Their

property consists of 160 acres, being the southeast quarter of section 28, town 47, range 26 west, in the Cascade region. Mining was commenced during the summer and about 3,000 tons were taken out ready for shipment, but transportation could not be had and it was not taken away. The ore is a red specular, and the deposit seems to be large and rich. It is understood that work will be continued at the mine during the winter, in stripping, improving, &c., so that the company may be able to ship from twenty thousand to twenty-five thousand tons of ore next season. About a dozen houses have been erected on the location, including a commodious boarding house and a barn. A side track connects the mine with the Cascade Branch of the Chicago & Northwestern Railroad. The officers of the company are as follows:

President, Wm. C. McComber, Negaunee. Secretary, C. H. Hopkins, Negaunee. Treasurer, James Mathews, Negaunee.

CARR IRON COMPANY.

This company was organized in July on a capital stock of $250,000, and owns forty acres of land on section 35, town 47, range 26, directly south of the Gribben. It commenced operations on the 18th of July, by opening on the north line of its property, and has mined about 2,500 tons of ore. The ore is principally of the flag variety, entirely free from jasper, and has been tested at the Tioga Iron Works, at Mansfield, Pa., and pronounced equal to any Lake Superior ore.

The company has built a large boarding house and barn, besides three other smaller buildings for employees. It is proposed this winter to tunnel into the main hill directly under the present working, and to build an independent side track about half a mile in length. It is owned and managed by wide-awake, go-ahead men, who have the money to develope their property, and propose to do so at once. About the centre of the present opening is a vein of ore which differs materially in structure and richness from any yet uncovered in that region, being remarkably open and porous while possessing great weight and purity. This vein, which was about three feet wide at the opening, has shown a constant divergence of its walls in their descent, and, it is believed, will be found at the bottom of the proposed tunnel to be thirty or forty feet in width.

The officers of the company are as follows: Amos Root, Jackson-Mich., President; E. W. Barber, Jackson, Secretary; M. H. Maynard, Marquette, Managing Director.

THE SMITH IRON MINING COMPANY.

The property of this company is located on sections 18 and 20, range 25, town 75, consisting of 412 acres, in the former section and 386 in the latter, all being located west of the west branch of the Escanaba river. The company was organized on the 1st of November, 1871, through the purchase of an interest in the property by Gen. James Pierce, of

Sharpsville, Pa., and Henry Fassett, of Ashtabula, Ohio. The original tract was the property of Silas C. Smith, and consisted also of section 28, in the same range, but this section still remains the property of Mr. Smith. The first opening was made on section 20 some two years previous to the organization of the present company, and sufficient ore taken out to render satisfaction regarding its character and quality. Subsequently the south-east quarter of section 18 was found to present better advantages for mining, and this was adopted by the new company as the principal point for working

The ore is mainly a hard brown and red oxyde, with strong indications as the deposit is worked of running into a hard specular ore.

The base of operations is located at a low point near the centre of section 18, where pockets and docks are located for the loading of cars. The cars are brought in on a branch road, five miles long, from the Chicago & Northwestern Railway. This branch was commenced last year and completed during the winter of 1871–72, so that shipments were made over it early this season. The deposit of ore has been traced from near the centre of the north boundary of section 18, extending diagonally in a southeasterly direction to near the centre of section 20, if not to the centre of the south boundary of the latter, in all a distance of one and a half miles. Operations until now have been conducted by stoping into the vein, at different elevations, in a southeasterly direction, against a rise of ground which offers the most advantageous surface for working. But a tunnel has been driven under the lowest stope a distance of 150 feet, and is to be carried 150 feet further, to reach a point within the main deposit, where a breast can be opened, and the stopes already opened can be worked down to the tunnel level without using hoisting machinery, and where the ore can be loaded directly on the cars for shipment.

The advantages of this plan are obvious. By the use of a small locomotive—"The Boy"—and a switch and siding outside of the tunnel, the carting and elevating of the ore is entirely dispensed with, while the mine can be worked to a depth, at the highest point now stoped, of over 100 feet, and will always be perfectly drained without the use of pumps. The tunnel serves the purpose for which an ordinary cut is used, in giving access to the mine, but to a greater extent and to much better advantage.

The refuse of the mine will be hauled away by "the boy" and deposed in a deep depression about two-thirds of a mile north of the mouth of the tunnel.

Meanwhile the pockets and docks which have been used will be used as heretofore for the reception of ore taken from the surface in the stopes on the vein highest up the elevation. A shaft, at one of these highest points, from which considerable ore has been taken, and which was worked by a whim, has been abandoned, the expense and inefficiency

of the method being a serious objection to it; but besides being very productive, this shaft has served the excellent purpose of demonstrating the depth and extent of the deposit.

It can hardly be said that there is a foot or hanging wall with this deposit, as it has no perceptible dip and the side walls are nearly perpendicular. The ore is found to be remarkably uniform in quality, being of the hard grades of hematite, and the deposit, while maintaining the same general course across the property, narrows and expands, and varies somewhat from the line, as if the boulder and sand drift by which it is accompanied had compressed it with varying force on either side.

It would seem from all the appearances presented by the openings so far made, that this vein was practically inexhaustable, as work has been done on the surface of it for nearly a half mile, in each case proving not only the richness of the vein but in many cases presenting the strongest evidence of its association with specular ore, either below it or running parallel with it. The tunnel now being driven under the lower stope will be apt to demonstrate the correctness of this suspicion, for its course, before reaching the ore, runs partially across the formation, and its interior end will eventually be deep enough to test the question at the lowest level of the mine.

Near the centre of the south boundry of section 20 a deposit of soft hematite has lately been discovered. A shaft has been put down a distance of 20 feet, through a mixed and inferior quality but at the bottom, and in driving a shaft six feet into the formation at the bottom, a superior quality of ore has been found, without the least granular tendencies, and in richness and purity fully up to the best hematites we have seen in this region. The extent of this deposit is not known, but the simi larity of the surface formation for some distance around, leads to the be lief that it is not inconsiderable.

The finding of this softer ore, nearly on a line with the continuation of the main range, might be regarded as an evidence that the belief, that specular ore would be found beneath or near the range, was not well founded. But the formation in the two cases is entirely different. In the case of the hard hematite it is sand, drift sandstone and iron slate, and in the case of the soft hematite it is a red shale, broken and soft.

The capacity of the store pockets in use at this mine is 500 tons. They are now filled and there is besides some 2,500 tons in the dock stock piles. The shipments this season were 13,445. This amount will be considerably more than doubled next year.

The company have a saw mill a little distance from the mines, on a tributary to the Escanaba, and there is a great deal of valuable pine timber scattered over the property. Several neat tenements have been erected and it is the intention to improve the streets and lay out garden plots for the comfort and satisfaction of the inhabitants. A school house will be built next year, and most likely a church. The employees

now consist of one hundred men, and the number is being gradually added to. A large boarding house, a store, blacksmith shop and horse barns, are also on the location. Mr. Wallace Pierce, of Sharpsville, is the efficient superintendent.

THE CHIPPEWAY MINE.

The Chippeway mine, which was opened over two years ago, and abandoned for the time being, has been offered to the market in fee simple, or by which to organize a mining company, by the sale of a two-thirds interest. When first placed before the public, a few weeks ago, in this manner, there seemed a prospect of making the scheme a success in a short time, but the time given to the parties to effect such a move having expired, the property reverted back to the owners, who have advanced their terms considerably, and now feel disposed to await a stronger move without giving to any one a temporary advantage.

The property consists of a fee simple of 640 acres on section 22, town 47, range 30 west, in possession of I. S. Waterman, of Philadelphia, and S. S. Burt, of Marquette, and is located one and a half miles south of Lake Michigammi, near the present terminus of the old survey of the Marquette & Houghton Railroad.

The ore is of a micaceous specular class, favoring the black oxide, or magnetic. The test needle shows that a lode from ten to fifteen feet wide lies along the property, from north to south, which, where opened, appears to be of uniform quality. The location abounds in white granite, with many large drift boulders, which cover and bound to a greater or less extent the iron range. A shaft has been made on the south side of a ridge, which shows abundant specular outcrop across its highest elevation, and in this was found, at a depth of twenty feet, a lean specular ore. In a pit adjoining the specular and magnetic mixed are found. Lower down the slope of the ridge, and on a plane a little below the level of the shaft, a pit has been opened which uncovers the whole width of the range for twelve feet, and running off into a drain twelve feet further, shows a body of ore of uniform quality, every inch or pound of it being as nearly like the rest as possible, with every indication of a deep working face. The covering is an iron slate and soap stone, broken at the surface but laying in a mass directly over the iron, the whole ranging from five to eight feet in depth. The ore is very firm, close grain, thickly set with flakes of decomposed mica, and assays 56 red hematite and 26 magnetic oxide, with a small per cent. of alumnia, silica and magnesia, and will yield 60 per cent. of metallic iron throughout. Under a strong magnifier it has the appearance of soft wrought iron, and it is undoubtedly as fine an ore as has been found in the district, and the only mine of this particular quality so far found on this continent. We are informed that every assay and test which has been made of it shows that although not as rich as some ores, its quality is far superior to even those which have been pronounced the best.

The valuable indications on this property should prompt the sinking of a shaft at the point where this pit has been opened, to a depth of twenty or twenty-five feet, and a cut across the vein, to demonstrate completely the extent of the deposit.

The location is well situated for economical working. A branch railroad can be constructed along a valley up to the opening without any material cuts or fills, and a large proportion of the ore lies at such an elevation as to be taken out without the aid of machinery.

We understand that the Marquette, Houghton & Ontonagon Railroad Company have consented to put in order that portion of their road leading from Champion toward this mine, a distance of seven miles, on the south side of Lake Michigammi, as soon as the mine is opened to ship ore, and there seems to be no reason why a large business could not be done with but little work and light expense in the commencement.

SPURR MOUNTAIN IRON MINING COMPANY.

This company was organized last August, and commenced operations by the purchase of the south half of the northwest quarter and the north half of the southwest quarter of section 24, township 48, north of range 31 west, embracing that portion of the Michigammi Iron Range including the celebrated Spurr Mountain, and in all 160 acres of land.

Capt. W. H. Morrison was soon after placed in charge of the location, and the work of developing the mine and facilitating access to it at once commenced. Roads were cut out to the town of Michigammi, and to the saw-mill on the west end of Lake Michigammi, and houses and a blacksmith shop constructed. The mine was uncovered, and test pits disclosed an immense deposit of first-class black magnetic ore, yielding from 65 to 69 per cent. of metal, remarkably free from deleterious substance. The show of ore is very large. The hill is a hundred and twenty-eight feet high at the point where work has commenced, and a drift into it at its base of ninety feet from the south side, has not reached across the deposit. The ore is of the same high quality throughout, and the mass apparently inexhaustible. The hill extends to the eastward from this point eight hundred feet to a stream affording a splendid water power, and again rising from the east bank of the stream extends to the east line of the location. To the westward it also reaches to the west boundary line. Throughout this range the magnetic compass indicates the continuance of the same deposit or vein.

Stripping has been done from the highest point to the base of the hill on the south side of Spurr Mountain proper, and at this point mining operations will be at once commenced and carried on throughout the winter by as large a force as can profitably be worked. The main line of the Marquette, Houghton & Ontonagon Railroad runs through the

location, and is two hundred feet south of the mine. A side track of eight hundred yards in length, with its summit at the foot of the mine, is constructed, connecting it at each end with the track to Marquette and that to L'Anse respectively. The distance is twenty-four miles to L'Anse and thirty-nine to Marquette, and ore can therefore be shipped with equal facility at both ports.

The improvements already complete, in addition to the roads and stripping above mentioned, are a large boarding-house, two large dwellings, ten smaller dwellings, a barn, and a blacksmith shop. The force now employed, in addition to the captain, is thirty men and six teams, and this is to be increased by miners whose work is now ready for commencement.

In quantity and quality of ore, facility for mining and loading on to cars, and with the two ports to ship from, this mine is one of the most promising in the entire district.

Its officers are—Henry N. Walker, President; Freeman Norvell, Secretary and General Manager; T. B. Brooks, Consulting Engineer; W. H. Morrison, Mining Captain.

THE MICHIGAMMI COMPANY.

For two years or more a party of gentlemen who have not been pretentious regarding their possessions, have been quietly awaiting the development of such events as would sooner or later enable them to open a mine of magnetic ore, and give them facilities for placing the ore on the market. These gentlemen have associated themselves under the corporate name of the Michigammi Company, with the following officers:

Wm. H. Barnum, New London, Conn., (of the Iron Cliffs Company,) President; Jas. Rood, Chicago, Secretary and Treasurer.

Directors: Wm. H. Barnum, New London, Conn.; Wm. M. Gaylord, Northampton, Mass.; Chas. J. Canda, New York; C. B. Hebbard, Detroit; Jacob Houghton, Michigammi, Superintendent.

There are several other prominent gentlemen interested in the company. The property consists of 1,400 acres on the north shore of Lake Michigammi, comprising nearly all the property on the north boundary of that lake.

They have commenced operations on sections 19 and 20, Town 48, Range 30, where they find a range of black magnetic ore 1,400 feet long, of an average thickness of 25 feet. This deposit of ore lies on the side of a ridge high above the railroad level, and but from 150 to 300 feet from the track.

[It is not improper for us to say here, and now, that the immense deposit of iron which was known to exist on the north shore of Lake Michigammi, was the means of changing the route of the Marquette, Houghton & Ontonagon Railroad from the original survey on the south shore of the lake to its present position on the north shore. The wis-

dom of this move will not be disputed, nor can the Michigammi Company fail to realize the importance of this change in connection with its interests.]

Four cuts have been made from the railroad into the range of ore mentioned, on sections 19 and 20, extending from 150 to 300 feet into a face of black magnetic ore from 20 to 25 feet high. The ledge seems to have been placed purposely for convenient and economical operation.

In making the cuts to get at a working face, from two to three thousand tons of ore were taken out, and the entire face of the ledge, when it is desirible to strip it, will supply enough ore to pay a good profit on the work of stripping.

The company are the proprietors of Michigammi village, which has now some two hundred inhabitants, with neat houses and stores, and churches and schools in the near future, and one of the best saw mills on the Upper Peninsula. The saw mill is designed to cut 40,000 feet of lumber per day, and the same establishment has in use a planing machine, a lath mill and a shingle machine.

Over one hundred lots of the village plot have been sold within sixty days.

Tracks are to be laid in the cuts mentioned, and stripping enough has already been done to work the property to the extent of from 30,000 to 60,000 tons next season without further expense for surface work.

This is one of the most promising locations in the Marquette Iron Region. It has, as advantages for its development, the support of eminent capitalists—an undisputed deposit of ore—the favor of railroad facilities—an outlet at L'Anse or Marquette, as circumstances may suggest, for the convenience of lake shipments—and the best of experience in all that pertains to the advantages or peculiarities of iron ore developments, mining and marketing. If this enterprise should fail, then any similar enterprise, engaged in, anywhere in this district should fail. But while all things are so favorable, for the success of this company, the least we can say is, that they should ship the 60,000 tons, next season, rather than depend upon the 30,000 tons as the lowest limit of their capacity.

THE NORTH MENOMINEE RANGE.

Within two years past it has been determined beyond all question that there is a rich range of iron ore running down the southwest side of the Menominee River, from near the outlet of Michigammi Lake, for a distance of six and a half miles, to a point on a line of longitude with the Republic mine, the latter being on the north side of the river. Whether it extends below this point the explorations do not show. The range has been traced from section 30, Town 49, Range 30 west, making a curve through the southeast quarter of section 19, and passing east through section 20, 21, &c., down the south side of the river to the point

opposite the Republic before named. At its beginning, on section 31 is an

UNDESIGNATED DEVELOPMENT

Which is being carried forward under the patronage of Judge Edwards, of Marquette. At this point there seems to be three parallel veins lying in a curve, at the head of the range, with a quartzite rock in the inner area of the curve and a greenstone on the outside. The inner vein is a thin but good magnetic ore, the next a black magnetic of fine quality, and the third a banded magnetic considerably mixed with rock, with walls of quartzite between the veins, and all of the veins having a dip which widens the circle as they are followed down.

The range of magnetic seems to extend westward from near the base of this curve, but how far or to what extent of richness has not been determined.

Considerable careful exploring has been going on in this locality during the last half of this year, but nothing done which fully determines the value of the veins. We are informed that it is intended to continue the explorations to an extent sufficient to set all doubts and hopes at rest.

THE MAGNETIC MINE.

This is located on section 20, on this range, after the curve has been made and where the range seems to start on its direct course down the south side of the river. Work was commenced some three years ago on the face of a ridge which forms the north side of the range. Subsequently a space of 300 feet long was stripped, which opened a working face of ore some 30 feet high. About 500 tons of ore was taken out of this opening, and, though a black magnetic of good quality, it was closely banded with greenstone and could not be mined to advantage without especial attention to assorting, and the opening was abandoned. A quantity of it was hauled out some three miles to the terminus of the old survey of theMarquette & Houghton railroad, but for some reason was never shipped. Meanwhile the prospects of the mine not being of the best, nor the prospects of the Chippewa on the north side of the river, that portion of the Marquette & Houghton railroad leading to this neighborhood was not put in running order, the main line of the road having been changed to the north side of Michigammi Lake.

Then operations were commenced by the Magnetic Company a few rods further west on the range, where the outcrop and test pits indicated a good body of clean dark magnetic. A shaft was commenced, which is now down 60 feet, on a footwall of quartzite, at an angle of 40 degrees, and through a solid lode of clean, fine grained, black magnetic ore which is 10 feet broad at the surface, and at the bottom of the shaft where a drift has been carried across the vein 28 feet wide. Test pits on

either side of this shaft show the presence of precisely the same quality of ore, in mass, for a distance of nearly one-half mile. The lode dips north at the angle shown in the shaft, and the hanging wall is soapstone, overlaid with greenstone. The ore is of remarkable close grain and purity, the only foreign substance which can be noticed by the naked eye being a mere trace of hornblende. There are here and there light seams of crystalized ore, of magnetic tendency, in the lode, and thin seams of granulated slate ore, which crumbles easily and has the appearance of iron dust, each particle covered with plumbago.

The foot wall under this vein is 15 feet thick, and it overhangs another vein 3 feet thick of specular ore. The same characteristics which seem to prevail at the Edwards opening, on section 31, are plainly developed here, in the presence of three parallel veins of ore.

The shaft at the Magnetic mine was carried down but 60 feet to get at a natural drainage level, as also at a level which will permit the use of cars through a tunnel or cut from the survey of a projected railway along the river. The shaft was commenced in April, 1871, but most of the work on it was done this season.

The mine is now in the most available condition for work, as soon as railway facilities can be furnished to take away the ore.

We are informed that the Directors of the Marquette, Houghton & Ontonagon Railroad have resolved upon a meeting to be held early in January, for the purpose of providing transportation facilities for as many as may be prepared to commence operations on this range. But whether this branch road will run out by the way of the Republic mine, whether it will be located on the west side of Michigammi Lake, connecting with the main line on the north, or whether the old survey, on the south side of the lake, where seven miles of track is already laid, will be adopted, is yet to be determined; but we have the best of assurance that such a branch will be constructed, for the accommodation of this range, early next season.

MISCELLANEOUS.

East of the Magnetic mine, on section 21, and between the river and the magnetic range, is the Cannon mine, where a body of slate ore has been exposed for a distance of 600 feet, over a width of from 40 to 50 feet. This property—600 acres—is in the hands of Philadelphia parties mainly, Wm. H. Stephens, (now of Detroit,) being President of the company, and B. A. Hoopes, of Philadelphia, Secretary and Treasurer. Samuel Peck, Esq., of Marquette, is one of the owners of the property. This is awaiting railroad connections for development.

Still further east, on lot 26, is an opening of micaceous specular, which, though but partially developed, seems to warrant a belief in the existence of a good body of ore on the spot.

In this manner the evidences of an extensive and continuous range of ore from the Edwards opening to the point opposite the Republic,

are abundant, and developments will undoubtedly be made as soon as assurances are given that railroad transportation will be provided for the ore.

THE CHAMPION IRON COMPANY.

This mine continues to be regarded as one of the best, if not the best working mine in the district. The belt of ore which was commenced upon in 1867, has not been found to vary from its nearly direct east and west course, and it lies in such mass, without being interrupted by rock divisions or bands, or material contractions, that the supply of ore seems inexhaustible. The only point in question is how to take out the ore most economically and in sufficient quantity to meet the demand in market for it.

All the workings of this mine continue in pure ore, as has been the case from the beginning, in a succession of shafts and drifts extending over a distance of a half mile in length, by from 50 to 100 feet in width, the slate ore in the west end and the magnetic in the east, the only case of foreign matter being a light seam of rock running across the formation between the two classes of ore.

The mining has been done by taking out the ore in drifts and breasts, on different levels, leaving from twenty to thirty or more feet of the formation between the levels, and elevating the ore in skips through shafts, of which there are four in operation, the hoisting cable for all of which is driven by the same engine, simultaneously or separately, as occasion requires, the cable being transmitted over sheeves from the engine house to the skips.

This system is to be continued, and is now being considerably extended by the sinking of a shaft 360 feet from or east of No. 1, and another 700 east of the first. Some 700 feet further east is the oldest, or first opening made in the mine, but which has not been worked since 1868, owing to the more favorable advantages presented for work by the ground on the west.

The first of these shafts, adjoining No. 1, is down thirty-five feet, and the second one has but lately been commenced. It is intended to sink them deep enough this winter to connect by means of a drift with the 100-foot level of No. 1, and the drifting from No. 1 toward the new shafts has already been carried forward 140 feet. Of course, they will eventually be carried lower, and be put in communication with the deeper levels of the series of shafts on the west.

Shaft No. 2 is going down to the fourth level, which will make it 240 feet deep. The foot wall in this shaft assumes a more vertical position as it is followed deeper, while the hanging wall maintains the same angle as was found above, thus gradually giving greater width to the vein as the miners get deeper into it. On the third level of No. 2, and 55 feet west of the shaft, a winze is being sunk to the fourth level, and this winze and the shaft will be connected. On the second level and 60

feet east a winze is being sunk which is to be connected with the third level.

Shaft No. 3 is going down to the fourth level, with a winze on each side of the third level to connect with the fourth.

Shaft No. 4 is going down to the second level, which, owing to a falling off of the ground going west, will bring this second level of No. 4 on a line with the third level of No. 3. Winzes are going down on each side of the first level of No. 4, which will connect with the second.

There have been no further underground improvements during this year, nor no new discoveries of ore, the work progressing very favorably and satisfactorily; but Capt. Wilson has reason to believe that a large body of slate ore will be found between the new shafts on the east.

Above ground a hoisting engine has been procured to work the first new shaft and No. 1, and the services of the engine at present in use will be confined to Nos. 2, 3, and 4. Another engine will have to be put up to operate the new shaft on the extreme east. A new shaft house has been erected at No. 4. The company have put up a new, large warehouse and barn for their own use, and a new hall, which seats 200 people, for the use of the people of the village. Four new pockets have been erected at the shipping docks.

One hundred thousand tons is the figure set as the amount of ore to be taken out of this mine next year. The product so far is as follows:

1868	6,255
1869	19,458
1870	73,161
1871	67,588
1872	70,568
Total	237,030

THE WINTHROP, NEW ENGLAND AND SAGINAW RANGE

Among the developments sometime ago made in the mining of iron ore, in that part of the Marquette district lying south-west of Ishpeming, was the opening of the New England mine, the discoveries having been made and work commenced by Capt. H. G. Williams some nine years ago. Meanwhile the Lake Superior Iron Company had made explorations and taken up lands on the range, which embraces the Winthrop, New England and Saginaw. And the Lake Superior Company now control by far the largest proportion of the property, on section 16, 17, 20 and 21, of this range, or series of ranges which furnish almost every quality of ore found in the entire district. But we will defer details of the operations of this company, in this locality, until we have arrived at the point where we desire to embrace a full description of all their operations, and will appropriate this article to the other companies operating in this locality.

THE COURSE AND NATURE OF THE RANGE.

The deposits of ore commence, so far as is known from explorations, on the north-west quarter of section 28—town 47, range 27 west—at a point where the Boston mine has been opened, and extend in a north-westerly direction, embracing the Pendill & Mulvey mine, the Shenango mine, the Winthrop, the New England, the Saginaw, including the intervening openings of the Lake Superior Company, through sections 21, 20 and 19, to the Albion mine lately opened.

The ore, through a valley which traverses this diagonal course of latitude, is a hard brown hematite, lying in a continuous vein, of varying width, from the Boston, on section 28, and extending into the Saginaw on the north half of section 19. There are deposits of specular ores parallel with this hematite vein, on both sides of it, but not in the same regularity. The Lake Superior Company have an opening of specular ore on section 16. The Iron Cliffs Company have one on the north half of the north-west quarter of section 21, and the New England Company, next adjoining on the west, have, on the north end of their claim, not only a specular but a slate ore of first quality, with a hematite which is considerably harder than that found in the main range of hard brown hematite. Then the Lake Superior Company, next west, have as fine slate ore as there is in the district. And further west, when we reach the Saginaw mine, we find the brown hematite, the specular and slate ores, so juxtaposed as to suggest the belief that here is a junction of all these ores, or a base from which they radiate east and south.

Every location in the district is connected, by a branch, with the main line of the Marquette, Houghton and Ontonagon Railroad, and thus shipments are made without extra cartage or the employment of large numbers of horses.

The old Parsons mine and section 16 mine, of the Lake Superior Company, north of the brown hematite range, are being worked to a moderate extent, and it is intended that both of these locations shall yield a considerable quantity of ore next season. A new engine, pump, and skip road has been applied to section 16 mine, which pit is down some 60 feet, and from which several thousand tons of ore has been taken.

—Commencing at the Boston mine we will go over the ground again, reserving details of the Lake Superior Company's properties until we undertake a description of all of them further along.

THE BOSTON MINE

Was formerly the property of the Williams Iron Company. It was leased, during the present season, by L. J. Day, Green Bay; Mr. Anderson, New York; and Wm. Buys, Frank Austin and G. C. Ward, of Ishpeming. The property consists of the south-west quarter of the north-east quarter of section 28. Operations were commenced by this company on the first of October last. But a small force has been working.

A cut has been made from the bottom of a creek which runs through the property to the body of the ore vein, and stoping has been commenced upon a face of from twenty to thirty feet, a large proportion of which is good ore. It is intended to take out some 2,000 tons of ore this winter, to be ready for shipment in the spring, and have the mine in good condition for work next season.

THE PENDILL AND MULVEY MINE,

Is the next on the hematite range. But little work has been done on it, and no characteristics have been developed which give it especial prominence. We are informed that it is intended to work the property during the winter so as to be able to make shipments to quite an extent next season.

THE SHENANGO IRON COMPANY

Are operating next, on the west, to Pendill and Mulvey, having purchased, the same as the latter, of the Williams Iron Company. This company was recently organized by C. Donkersley and Mr. Smith, of Marquette; Mr. Decker, of Eagle Mills, and Messrs. Orthey, Hurd, and Hutchinson, of Negaunee; and active operations commenced a few weeks ago. The opening was an old one, but it had lain idle for some time. A few tons of the ore has been shipped to the Champion furnace since operations were commenced by the new company. The old pit is completely worked out, up to the west line of the property, on the stope first commenced with; but they are now stripping on a lower level, and propose to stope back with a twelve foot face over the old ground, and also to take down what ore may be found to extend in the side walls. The old opening is nearly 200 feet long, by about 80 feet wide, and if drainage can be obtained for the new stoping level the mine will work easy and economically.

THE WINTHROP MINE

On section 21 is next in succession, on the west. This has long been known as a very valuable mine. It is at present owned by A. B. Meeker and A. G. Clark, Chicago, and H. J. Colwell, of the Michigan furnace, and is operated by contract by Capt. Richardson and J. R. Wood.

The ore lies in place, almost absolutely clean, with a working face of from 20 to 30 feet on the stope now being operated. This stope is at a convenient level for shipping the ore directly upon the cars, and a large amount of stripping is being done to facilitate the continuance of work upon it. The opening commences on the east line of a 160 acre tract, and follows the course of the range northwest some 200 feet, by 100 feet wide. An excavation has been made in the centre of the stope to some distance below the working level, and a pump shaft put down to the depth of 30 feet. North of this shaft a winze has been sunk, and a drift cut through to connect the two. The shaft, the winze and the

drift are in ore, of as good quality as has been taken from above, and the mine throughout supplies the best of indications for encouraging the belief that it has a prosperous and profitable future before it.

Test pits on the west of this opening show the existence of the same quality of ore in mass across the entire tract. Pits which have been put down on the south of this heavy deposit of hematite, show the existence of a specular range, running almost parallel with the hematite; and it is quite certain that the hard ores found at the old Parsons mine, and at section 16 mine, of the Lake Superior company, forms a junction with this heavy body of hematite at or near this point, and that they run parallel with each other from this point west.

The amount of ore shipped from the Winthrop mine this season is as follows:

By Marquette	8,504
By Escanaba	5,066
To local furnaces	314
Total	13,884
Previously	12,319
Grand total, gross tons	25,203

This hematite range continues northwest, diagonally through a "forty" belonging to the Lake Superior Company, which is being vigorously worked on its western boundary where it joins, and is worked in the same opening with the

NEW ENGLAND MINE.

The New England consists of two "forties," or the east half of the northeast quarter of section 20. It has been operated for some years, and up to the present time 108,744 tons of ore have been shipped, 17,400 tons being the product of this season.

The mines consist of a bed in the hematite range, and a large deposit of specular and slate ores. The hematite property, or opening, is supplied with engine, pump, skip road, &c., and is in condition to be worked very economically for the production of a large amount of ore.

A few rods west and north of the hematite mine is an opening from which a large quantity of specular ore has been taken, with some first quality of slate, and a second class hard ore. A new engine has lately been put in to work this hard ore deposit more vigorously than heretofore. The lode, with a narrow seam of slate ore, seems to run across the entire tract, forty acres in width, on a ridge and parallel with the hematite range in the valley.

The buildings and improvements on this property are of the best character. Work is to be prosecuted with a view of making larger shipments next season than have heretofore been made in any single season.

The following table shows the work done by the mine from the time the first shipments were made:

1866	3,150
1867	9,075
1868	8,257
1869	12,632
1870	24,871
1871	57,985
1872	17,400
Total, gross tons,	108,744

This range of hematite, with its parallel veins of slate and specular ores, continues across four "forties" belonging to the Lake Superior Company, upon which but little work has been done, aside from taking out a few thousand tons of slate ore on the "forty" adjoining the New England, on the west—where slate ore is now being taken out—when we arrive at

THE SAGINAW MINE.

The property of the Saginaw consists of five forties, four of them being the centre of section 19—town 47, range 27 west—and the fifth being the north-west quarter of the north-east quarter of the section, upon which the principal developments of the Saginaw Company are located.

It will be remembered by some of our readers, that late in the season a sale of this property was made by Messrs. Longstorf, Maas & Mitchell, of Negaunee, to the present owners, for the sum of $300,000, independent of the improvements. This was considered an extravagant price to pay for it, and a most fortunate bargain for the parties who received that price. And more especially was this considered a good bargain for Longstorf, Maas & Mitchell, because they had the privilege of working the mine and disposing of the ore until the 1st of December.

But it is a question now, since the new company has come in possession, whether the old company received a dime more for the property than it was worth. Be this as it may, we have to acknowledge considerable surprise, upon viewing the property, to come into possession of facts regarding its richness.

The Saginaw Mining Company now consists of A. B. Stone, of Cleveland, President, and A. G. Stone, of Cleveland, Secretary and Treasurer, together with other Cleveland capitalists who represent heavy iron manufacturing interests in that city. J. P. Mitchell, one of the former owners, is retained as mining captain.

The principal opening consists of a cut from near the centre and southern boundary of the north "forty," extending easterly to the east boundary of the property, where it adjoins the lands of the Lake Superior Company. This cut commences with shallow stripping until it reaches the surface of the brown hematite range, where it runs into a good deposit of red specular ore, with veins of slate ore, which have a

dip to the north and seem to overlap the hematite. For a distance of ever two hundred feet this cut runs through a body of red specular, having an average face of 10 feet, with a cap rock and lean ore which more than pays for the stripping.

Mining has been pursued so vigorously during the past season—although active operations were only commenced with the beginning of the year—that the vein of red specular, which, with the lean ore which caps it, averaging a face of fifteen feet, has been taken out, and preparations are now making to go deeper. For this purpose a 20-foot shaft is to be sunk at a convenient point, in order to not only stope the ground over again, but to furnish a 40-foot face to work against on all the ore which was not taken out by the first cut. To facilitate this process a 60-foot shaft is being sunk into the hematite, on the south side of the mine, for the purpose of furnishing a well for a pump, to drain the entire mine, while another shaft, of the same depth, will be sunk into the specular ore, for the purpose of supplying means of communication with such winzes as it may be thought best to put down.

From near the beginning of this main cut another leads off to the north, which strikes a good deposit of ore, and which is as much a portion of the main body of the mine as if it embraced the same lode.

The hematite, lying parallel with and on the south of the specular ore, has scarcely been touched, but it is available, without further expense, at any moment it may be considered advisable to take it out.

On the northwest corner of this forty upon which the mine is located, an opening has been made which reveals a rich deposit of both the slate and red specular ores, the latter lying in a loose mass beneath a covering of mixed ore some six feet thick and the slate ore, slightly charged with magnesia, running through in regular order with the formation. A shaft forty feet deep has been sunk into the specular ore, and a pump is to be applied so as to take the ore out to the full depth of the shaft.

Side tracks are now being laid, engine houses and blacksmith shops are going up, the number of miners' dwellings is being added to, a saw mill has been purchased and will soon be put in operation, and everything about the mine betokens vigorous management and a prosperous future, and it is expected that not less than 50,000 tons of ore will be taken out the coming season. The quantity shipped during the last season was 18,503 tons.

THE ALBION MINE.

This is almost entirely new, and so far as developed seems to partake of the nature of the Saginaw in point of promise and variety and richness of ore. Only 937 tons were taken out this season, but stripping and other preparations are being made to do a large amount of work next season.

THE CLEVELAND MINE.

Parties who some years ago thought the Cleveland mine did not pre

sent sufficient prospect to hang a hope upon, will now have to give way to the influences which time developes, and acknowledge that prognostications are of but little avail when not sustained by greater facts than appear on the surface. Reference has been made, in previous reviews, to the early struggles of this company, and the large expenditure of labor and means neceessary to create an equipment for the shipment of ore, in the opening of the mine, the building of plank roads and docks, and the introduction of machinery, as well as the vibration of the faith of the company between hope and fear.

The early troubles were not so much caused by the absence of faith in the richness of the mine, as for want of system in operating it. Instead of following leads of ore to a depth where good results could be obtained by taking it out from the mass in place, operations were mainly confined to the surface, in removing rock from the most diversified and perplexing formation yet found in the Marquette iron district. When water became troublesome at one point operations would be transferred to another, and it was not until a most persistent system of mining at considerable depth had been adopted, during the years 1867 and 1868, that the magnificent results which now distinguish the company began to be realized.

We have not found in any iron mine in this district or elsewhere, a greater diversity of formation, in the direction, dips, and angles of the iron lodes, than may be seen here. These peculiarities prevail in every opening yet made, and these geological characteristics do not seem to conform at all to the general character of the formation in other parts of the district, in which the iron has a prevailing dip to the north, and for the most part runs in lodes east and west. The work of the past season has developed this fact more than ever, and, though a considerable depth has been reached in all the openings, it is yet a question of doubt whether the ore beneath lies in any more regular form. Veins dip to the north and to the south, and are crossed and interlaced with other veins. The angle is sometimes acute, and then in cases changed to a very moderate inclination. The lodes run off in fins and legs, or extend in serpentine form around a column of rock, as if they had been formed by being heated and well fluxed with rock, and then discharged into a lake of water to cool in the most promiscuous and ebullient manner possible. In short it is a very complicated mine.

THE ORE—ITS PECULIARITIES.

There is but little of the soft red or brown hematite in this mine. There has been found here and there, in one of the principal openings, small deposits of crystalized hematite, or sulphuret of iron, considerably mixed with foreign matter, and containing a small per cent. of magnesia, but no claim can be made to the possession of such beds of the red and brown oxydes as are usually found in, or in juxtaposition with the specular ores. The ore is a very hard granular, or peroxyde

of iron, of nearly the same quality throughout the entire mine. It was found very hard when the mine was first opened, but in some cases seems to increase in hardness as greater depths are reached.

THE PROPERTY OF THE COMPANY.

The Cleveland Company's property consists of three thousand acres located at various points throughout the iron district. The Cleveland mine proper, consisting of eight openings, in one group, is situated on the eastern limits of the village of Ishpeming. An additional opening, now being worked, is located a short distance further east, and known as Section No. 2 Mine. And another mine, known as the Marquette, owned and operated by stockholders of the Cleveland, lies to the south of the pioneer location.

MINES NOS. ONE, TWO AND THREE.

These lie on the north boundary of the pioneer location, and comprise the first openings operated. They have been worked with considerable vigor during the year now closing, and now present the following characteristics:

No. 1 is on the northeast corner of the location. It is an open pit, on an elevation, and has produced, this season, without offering difficulties or obstructions to work, 10,000 tons of ore.

Nos. 2 and 3 are literally one mine, the two having been thrown together by taking down a partition wall. The whole opening is 340 feet long by 150 feet wide, and 65 feet deep. On the north side of it the ore has been mined out against a foot-wall of greenstone, which separates it from a triangle of No. 1, which lays in wedge shape behind it, the main body of No. 1 being further east. A drift is in contemplation, from the bottom and centre of Nos. 2 and 3, through the greenstone, into No. 1, which would give access to a working face of 125 feet, over an area of 300 by an aggregate of 50 feet. The ore taken from this face could be elevated and loaded upon cars by the use of the same shaft now appropriated to the use of Nos. 2 and 3.

Near the centre of that portion of the opening, which comprises Nos. 2 and 3, and which constitutes No. 3 proper, a cross-cut has been made, to the depth of 32 feet. At the south end of this cut the elevating shaft—heretofore alluded to as the exit of ore from this opening—is located. This cross-cut will afford 32-feet working faces, east and west, below the present level of the opening, and an incalculable amount of ore can be taken out on the new level before the present exposed area of the bottom of the pit is worked over.

To open this pit to its present dimensions, an immense amount of grey trap, which overlaid the southern portion of it, to the extent of near 30 feet on the south line, had to be removed. And now the miners are at work in breasts of ore, under the trap, following the dip of the

lode, leaving columns standing for the support of the hanging wall, or mountain roof above it.

The hoisting shaft is located near the western extremity of the opening, on the south side, and comes down through the hanging wall and ore. This shaft comes down to a "bench," 65 feet below the surface, on a level with the present bottom of the mine. An auxilliary shaft—intended more especially for a pump and drainage—has been sunk to a depth of 100 feet, in close proximity to the base of the hoisting shaft. As this shaft has quite a duty to perform in the way of future service to the mine the careful reader will want to remember it.

After noting that openings Nos. 2 and 3 yielded, during the past year, 45,127 tons of ore, we will move east to

MINE NUMBER FOUR.

This mine, or pit, is located almost at right angles across the east end of Nos. 2 and 3, and the lode of ore which is being mined has a dip, apparently, directly beneath the east end of Nos. 2 and 3, but extending off south into the grey trap rock which covers the south side of Nos. 2 and 3. The ore vein, some 24 feet below a roof of red soapstone, is 240 feet long and 18 feet thick.

This is a decidedly unprofitable mine to manage. Some 6.000 tons of ore were taken out during the last season, but the roof is so treacherous that it would not seem like policy to pursue the work of mining without expending more in support, by way of ore columns, or artificial means, to gurantee safety to workmen, than the property might be worth. On the south end the roof is better.

The position of this ore is one of the peculiarities of the geology of this location. It dips as if it ran under or intermingled, at right angles, with the eastern end of the deposits of Nos. 2 and 3, and runs down southwardly, on a tangent, into the grey trap which overcaps, or forms the hanging wall of 2 and 3.

THE INCLINE MINE.

This is located about 300 feet south of Nos. 2 and 3, and lies nearly parallel with it, being 400 feet long by 250 feet wide and 60 feet deep. On the north side of the opening the formation corresponds almost exactly with that of the south side of Nos. 2 and 3, north of it, except that small deposits have been found here and there, of crystalized hematite —and there is every indication that the lodes of ore being worked on the north side of this, the Incline mine, and on the south side of Nos. 2 and 3, are the same, having been formed in V shape, with the central space filled with grey trap, and the east end of the V closed up by the cross-deposit of mine number four, before referred to.

This indication, or impression, is confirmed by the fact that a pump shaft, put down between these two openings, passes down into the grey trap 145 feet, and then sinks into the ore to the depth of 30 feet.

The Incline mine derives its name from a double tram road which has

been used to elevate the ore. It has been worked out very clean to its present dimensions, but is yet stoping up on three faces of fifteen feet each, and has produced this year 50,261 tons of ore; and, besides having the vein dipping to the north, before alluded to, has connection on the east with No. 5 mine, through an opening made by taking out a vein of ore, and on the west seems to connect with a lead of ore which runs off wild-catting toward the south-west.

In its western extremity a shaft is being sunk to a depth of 100 feet below the present level of the opening, and it is intended to drift from this shaft to the pump shaft before alluded to, and from the pump shaft, on the same level, to Nos. 2 and 3, and by this means drain the entire group of mines, at a depth of 175 feet, by means of one shaft, which is to be supplied with proper pumping apparatus.

The auxillary shaft, before alluded to, below the bench of the hoisting shaft of No. 3, is a part of this system of drainage, and when the plan is completed every mine of the group can be kept free of water for years to come.

THE NUMBER FIVE MINE.

This is east of the Incline and south of No. 4, occupying the principal portion of the south-east corner of the plot covered by the group. It is 325 feet long by an average of 50 feet wide, and now has two stopes with twenty-five foot working faces. The deposits of ore in this opening are very irregular, and as they are followed present so many fins that it is difficult to determine which is the best to work upon. Over 10,000 tons of ore have been taken out of it this season.

Between this and the Incline mine there stands a large mass of rock —a mountain, almost—as also two or three smaller warts of rock within the Incline—which will soon have to be disposed of. It is the present purpose of the company to make an exit from the Incline westward, put on a small locomotive, and remove these excrescences, to afford room to work the deposits of ore around them to advantage.

Still further east, and very nearly on the east line and to the south of No. 1, is the Little Mountain mine, which yielded 6,000 tons of ore during the last year. It has no striking peculiarities aside from the irregular nature of the formation, which corresponds with the other mines on the location.

THE SCHOOL HOUSE MINE.

This is located a few hundred feet south-west of the group we have described. It consists of an opening 650 feet long, by an average width of fifty feet, from which a large amount of ore has been taken, but which just now exposes a 24-foot vein thirty feet below the surface, dipping to the south, which has been worked into, under a roof of gray trap, for a distance of forty feet in width and 100 feet long. It is an absolutely clean ore, almost as hard as steel. At a distance of 180 feet from the

western extremity of this work a shaft has been sunk on the vein to the depth of 130 feet. From the bottom of this shaft a drift has been made for a distance of 70 feet across the vein, which shows an unusually strong and rich deposit of ore. A drift to connect this shaft with the body of the mine is now being driven, and another to run back to a pump shaft in the Incline mine.

The School House mine produced, during the season just closed, 19,200 tons of ore, and has capacity for twice that amount if it is thought best to so work it. In addition to the 24-foot vein which dips to the south, the lode which led to it has not all been taken out, and this, on the east end, is yet quite productive.

MISCELLANEOUS.

The School House mine is operated by an engine put up purposely for it. The Incline mine and Nos. 2 and 3, and the principal pump shaft, are operated by engines located near the western boundary of the group; while the Little Mountain mine and Nos. 4 and 5 are operated by another engine suitably located between them.

The Section 2 mine, alluded to in the beginning of our description, was opened in 1871, but no ore was shipped until this season, and its product for 1872 is 5,000 tons. The pit is seventy-five by thirty-five feet, and it has a working face of twenty-five feet lying twenty-five feet below the surface.

The product of the Marquette mine—also before mentioned—was this year 12,000 tons.

The product of the Cleveland Company properly for the year 1872, was 151,585 tons.

The machinery equipment is the best throughout. A large engine is now ready for use, in the principal engine house, for the pumps alone, in the new pump shaft. Three hoisting engines are in the same building, and a complete machine shop for repairs. The blacksmith shop, barns, coal sheds, change houses, and buildings generally, are first class, and a steam fire engine apparatus is in place, in the midst of the principal buildings and at all times ready for service.

Seventy horses and several oxen and mules are employed. A harness shop is in use for the manufacture and repair of harness. A shop is on the ground for the manufacture of tram cars, and another for the manufacture of sleighs, wagons, &c.

A saw mill is on the premises, which has a capacity of 10,000 feet per day, and which has this year manufactured half a million feet of lumber for the use of the company.

Shipments are made by both the Marquette, Houghton & Ontonagon and the Chicago & Northwestern railroads, and side-tracks and switches are so arranged that cars can be loaded from pockets or stock piles, as circumstances may suggest.

THE CLEVELAND DOCKS.

These docks, at Marquette, which now have twenty-nine vessel, and six steamboat pockets, with an aggregate capacity of 2,200 tons, are to extended, if weather and circumstances will permit through the winter, 350 feet, which will afford space for 54 additional pockets, or an additional aggregate capacity of 2,700 tons, making in all a pocket capacity of about 5,000 tons, and room to load six vessels at once.

They will also construct, on the shore east of their docks, a bulk-head with 600 feet water front and 400 feet in width. Their bulk-head, or in-shore dock, on the west side of the ore docks is 210 feet front by 300 feet deep. So it will be seen that they propose to have double their present dock room for the accommodation of business next season.

The stockholders of the Company have also organized a barge company, which is now having built, four steam barges, with consorts, for the transportation of ore in order to relieve the company of the dictation and oppression of vessel owners when transportation is brisk and ves sels scarce.

The officers of the company remain as before, with J. C. Morse as the efficient agent and local manager, and F. P. Mills. mining Superintendent.

The following is a

TABLE OF SHIPMENTS TO DATE:

Year.	Gross tons.
1854	3,000
1855	1,449
1856	6,343
1857	13,204
1858	7,909
1859	15,787
1860	40,091
1861	11,795
1862	37,009
1863	46,842
1864	45,927
1865	33,957
1866	42,125
1867	75,864
1868	102,213
1869	111,897
1870	132,984
1871	158,047
1872	151,585
Grand total	1,089,759

THE NEW YORK MINE.

This mine is located, as is well known, on the north and adjoining the Cleveland. The geology of this mine seems peculiar to itself. Two parallel veins of ore have been worked for some eight years past. The south vein yields a very hard specular ore, which runs at times into a

steel ore, the granulation of which is almost as fine and compact as hammered steel. Upon taking a piece of this ore from the dump, and breaking it over the edge of an iron-bound wagon box, we found a fractured face which presented a peculiarly tough and elastic appearance, with a fibrin so close that had it been presented, with finished exterior, as a sample of steel, we would have been puzzled to determine whether it was genuine or not, without the use of a glass or the appliance of a tool.

This specular opening is now worked out for a distance of 500 feet, by 40 feet in width, the eastern end still yielding a good quality of hard ore, and the western end, which is being stoped on two or three levels, yielding the first quality steel ore we have mentioned. On the south side of the eastere end of the opening, breast mining is being done under the hanging wall, following the dip of the vein, and there seems to be no reason why a shaft or cross-cut into a lower level would not guarantee a good face of ore on the same area which has been worked over.

A wall of rock some twenty-five feet wide, forming the foot wall of the specular vein, intervenes between that and a parallel lode of slate and hematite. This wall is used as a working level for the derricks, pumps, dumps, skip roads, steam power, &c., in use in both veins. The north vein, of hematite and slate, dips to the north and east, leaving a "horse back," the wall of rock mentioned, between them. It has been worked out to nearly the same extent that the specular vein has been worked. The hanging wall, of soap stone and slate rock, on the north side, is being taken off, to expose, so far as possible, the lead of ore. This is quite an expensive operation, as the covering is quite thick, but it cannot be avoided because the formation is not sufficiently firm to remain as a roof.

Some distance east of where the vein dips toward the east, a shaft has been sunk to tap the ore and if possible get at a good working face upon which to go back over the area worked down to the present level. This shaft is forty feet deep, but has not yet struck the ore. Drifting back under the old level, from this shaft, will probably next be done, to determine the prospects of the plans in hands.

Neither of these mines are seriously troubled with water, and the machinery and fixtures for working them are very complete.

A little distance north of these openings, and running nearly parallel with them, another vein of slate and hematite is being worked. It seems to extend a distance of nearly one thousand feet, and is from ten to twenty feet wide. This is on the north side of, and running parallel with, the Chicago and Northwestern Railroad. Its depth we did not ascertain, as it was filled with water at the time of our visit, and workmen were engaged preparing for the erection of an engine and pump, to enable the miners to renew their operations.

The following is the statement of the New York product for the nine years since the commencement of mining operations:

Year.	Gross tons.
1864	8,000
1865	12,214
1866	33,761
1867	43,302
1868	45,665
1869	67,698
1870	94,809
1871	76,381
1872	68,950
Total	450,775

W. L. Wetmore, of Marquette, still has charge of the business interests of the mine, and Capt. Dickinson the mining supervision.

THE IRON CLIFFS COMPANY.

The office of this company is at Negaunee, and their lands and properties in use are quite as extensive as those of any other company in the district. The lands comprise many thousands of acres, located at various points in the district, much of it being ore bearing, while a large proportion of the balance was purchased for the charcoal wood, and lumbering timber.

The iron openings now being worked by the company are the Excelsior mine, three miles west of Ishpeming; the Barnum, at Ishpeming; a new mine adjoining the old Parsons, southwest of Ishpeming; Section 15 mine, near Lake Angeline; the Foster, southwest of Negaunee, and Section 18 mine, on the Negaunee hematite range; all of which belong to the company. They are also working the Pioneer mine of the Jackson company, Negaunee, and own the machinery in use there. The Tilden and Ogden mines, southwest of Negaunee, formerly operated by this company, have been abandoned, the hard silicious ores coming from them not being regarded rich enough for the market. They are prolific in peculiarities, as almost every form, class and grade of ore known as unusual specimens, are found here. Yet the quantity of rich ore is so limited that it was concluded best to let the location rest, for the time being, and work was suspended and the branch railroad track taken up.

The company own two furnaces at Negaunee and one at the Foster mine, the latter yet incomplete. They also have a saw mill, shingle and lath mill, complete, at the Foster mine. They employ four hundred horses, and near one thousand men, including choppers, in the pursuit of their business, and use forty charcoal kilns to supply their furnaces with fuel. Their shipments of ore for 1872, amounted to about 58,000 tons. This does not include that mined for and consumed by their furnaces. And their product of pig iron was over 6,000 tons.

THE EXCELSIOR MINE.

This mine was opened early in the season, and 756 tons taken out and shipped. A large quantity of it is now being brought to the shipping docks of the Barnum, to be ready for the business of the coming season.

The ore is of a peculiar quality, being a specular with more or less magnesia and traces of manganese. The vein is clean and uniform, and the ore will undoubtedly prove very valuable for some especial purpose.

THE BARNUM MINE.

The quality and quantity of the fine specular ore of this mine continues to hold out well, while the fine fibrous or textile slate shows an increase in quantity as the vein goes down. The opening, which was nearly 1,000 feet long at the close of 1871, by an average of 60 feet in width, has been extended some distance westward, on a 60-foot level, and stripping is now going on to continue this extension. The entire vein has a dip to the south, and the drift which covers the hanging wall is being taken off over about one-half the distance of the opening to get out enough of the hanging wall to enable the miners to cut into the dip below the open level without incurring the dangers of slides of rock. This open level is something over seventy feet deep, and shafts which have been put down, two on each wall of the vein, with two drifts which communicate with these shafts across the vein, show a gradual widening of the deposit. During the past season an incline shaft has been put down on the north side of the vein, extending into it 50 feet below the open level. From the bottom of this shaft a drift runs off in an eastely direction, parallel with and through the vein a distance of 180 feet, intersecting the cross-drifts before alluded to. There is now a pump down this incline, but a pump shaft is to be made, 190 feet deep, to drain the entire mine to the lowest point at present worked, when the incline shaft will be used exclusively for hoisting. Hoisting apparatus is also to be erected to work the extension on the west end, instead of depending upon inclined cart roads. Some additional trestling and tram roads have been constructed during the season, to facilitate the dumping of rock and the docking of ore. The mine and all its appurtenances is in the best condition. The local superintendent is Capt. Murray, while Capt. Rowland, the general superintendent of all the company's mines, gives the work more or less of his attention.

THE CLIFFS-PARSONS.

This opening was made during the past season. It adjoins the old Parsons mine on the west, and is a continuation of it. A vein of soft mixed slate ore, 40 feet wide, has been uncovered for a distance of 300 feet or more, and a cut is now being made into it on the north side, to get a working face from 15 to 20 feet high. The lode lies at an elevation

on the north side of a hill, and many thousands of tons of ore can be taken out without the use of machinery of any description.

The Parsons mine—the first opening on this lode—is owned by the Lake Superior Company and is being worked by them.

THE SECTION FIFTEEN MINE.

This adjoins the property of the Pittsburgh and Lake Angeline Company, and was opened during the past season. It consists of a very fine bed of soft dark red hematite, from which ore is now being taken and hauled around the spur of a hill, nearly a mile, for shipment next year. A large quantity has already been taken out, and the contractor for the work thinks he will have no difficulty in removing from sixty to seventy tons per day all winter. A large area of this ore has been uncovered and it is now being taken out from a 15-foot face. Some test pits and a small opening, further east, show a continuation of the same deposit, while on the west the Lake Angeline Company have a face of 12 feet in it, and a shaft which was put down jointly on the boundary of the two properties went through the ore to the bottom of the shaft, 25 feet.

This has every appearance of being the best deposit of hematite in the region, clean, rich and practically inexhaustible, while a great share of it lies so high that it can be taken out as easily as sand from a bank.

THE FOSTER MINE.

This has been worked very vigorously during the past season and 18,000 tons of ore were taken out. The mine is reached by the Mineral Branch railroad, which leaves the Chicago & Northwestern road a short distance south of Negaunee. The mine consists of four openings, in close proximity, but the ore from each varies somewhat from that in the others.

No. 1 opening is the first one made, and is now nearly worked out. There is a little ore on the west end and the bottom, but on the sides it has run out.

In No. 2 the prospects are better. A face of forty feet is being worked, where thirty feet of hematite and rock are mixed beneath a covering of rock and soil of ten feet.

No. 4 is also regarded with considerable favor.

The location is an uncertain one, so far as the beginning of an opening is concerned, for the ore lies in pockets of greater or less magnitude, without regard to order, and many run out when least expected. A shaft has however been sunk to a depth of 72 feet, at one point, from the bottom of which a drift leads off quite a distance through a good body of ore.

The equipments, in power, pumps and hoisting apparatus, for working this mine are quite complete, but are to be materially added to during the coming season.

The following is a statement of the shipments from the different mines of the company up to the 1st of January, 1873:

THE BARNUM.

Year.	Gross tons.	
1868	14,380	
1869	33,484	
1870	44,793	
1871	45,939	
1872	38,381—	176,977

THE FOSTER.

1868	6,000	
1869	14,000	
1870	25,458	
1871	13,203	
1872	18,139—	76,800

SECTION EIGHTEEN.

1871	329	
1872	545—	874

EXCELSIOR.

1872	756—	756
Grand Total		255,404

By turning back to our review of the Negaunee hematite range, reference will be found to the Iron Cliffs Section Eighteen mine, in which it is stated that it is intended to ship from this mine, the coming season, no less than 20,000 tons. As much will undoubtedly go from the Excelsior, and not less than 10,000 tons from Section Fifteen, and the same amount, most likely, from the Cliffs-Parsons. This, without allowing any increase for the Barnum and Foster,—or without estimating what will be used at their furnaces—would make their product, in 1873, reach about 120,000 tons.

THE LAKE SUPERIOR COMPANY'S MINES.

The changes in the operations of this company, during the year 1872, have not been material, but yet of such a nature as would be expected of a company which is so earnestly engaged in the production of iron ore. To avoid the repetition of matter used in former reviews, we will undertake to describe the mines as they are now being worked, after the close of the season of 1872.

A NEW MINE.

An opening, on the east of the principal mine, and nearest the village of Ishpeming, which was but lately commenced, has reached dimensions of about 30 by 80 feet, and 20 feet deep, the bottom being on a good body of ore, which dips to the north and seems to lead to what appears to be a good mine of ore.

THE HEMATITE MINE.

The hematite mine of this company, adjoining their specular mine at Ishpeming, is, without doubt, the most remarkable, in point of the extent of deposit and quality of the ore, in the entire district. The open level, 90 feet deep, heretofore worked, has shown a richness, as depth was obtained, which was not expected.

This hematite opening is 400 feet long, in nearly an east and west direction, with an open level nearly 90 feet deep. This level is worked down close to the walls on both sides, at an average width of 60 feet, but each end shows a continuation of the vein to an undetermined distance. On the west end there is an immense quantity of ore mixed with rock, on the 90-foot face, which at this point is more than 80 feet wide; and at the east the work has been contracted to a much narrower space. Two incline skip roads, located about the centre of the north side of the opening, on the north wall, are now used to elevate the ore from this mine, or that portion of the ore which is worked out of the open level. But a perpendicular shaft has been put down, through the north wall of the mine, to the depth of 130 feet—40 feet below the open level. Drifts had been made a few feet below the 90-foot level, and some ore was taken out by means of them, but not long since these drifts fell in by not having been sufficiently well supported by timbers, and it is now intended to work from the deeper, or 130-foot level.

It is on this level where the most wonderful and promising features of the mine are shown. A drift has been made from the bottom of a 130-foot shaft, east and west, to a distance of 400 feet, *through ore*, and on the west division of the drift, two cross-cuts, 50 and 60 feet respectively, have been made *into the ore*, in a northerly direction. Winzes are also down, *in ore*, on the main drift, to a considerable distance from the points where these cross-cuts are started, showing a body of hematite 40 feet deep by 60 feet wide, and of unexplored length—possibly as long as the main drift on the lower level—400 feet—but most likely much longer.

Suffice it, that this deposit of hematite astonishes the best of miners, in its magnitude. It is intended to sink the perpendicular shaft low enough to make drift connections with the winzes which have been sunk below the lowest, or 130-foot level, now ready for the stopers.

It will be readily understood, especially by miners, how much ore can be taken out of the line of 510 feet of drift which has been made in this mine, on the 160-foot level, and how much more can be taken out after the hoisting shaft has been carried deeper and drifts have been made to connect the winzes already down.

The only question with stopers would be, as to the quality of timber, and the care exercised in putting it up to protect them, while taking out the ore, for as there is no rock, and the deposit is composed chiefly of the soft dark and red hematite, the labor of mining will be almost as easy as the labor of digging into a soap bank.

We would not undertake to call this the finest hematite mine in the world, but it is certainly the finest one we have ever seen located under ground, and more extensive than any which has come under our notice, among those which are located near the surface, or on the side of a bluff, as they usually are.

THE HARD ORE MINE.

Now we will move westward to the specular mine. It abuts almost directly against the hematite, as if making the latter its base, and, starting on a large body of specular ore, runs off in two veins, like the two sides of a triangle, to the north-west and south-west, with a great body of rock occupying the space between the two wings. The south vein, leading off from the point of this triangle, bears large quantities of fine slate ore, in addition to the hard hematite peculiar to the mine, while the north vein has less of slate, and abuts upon the mine of the Barnum, or Iron Cliffs Company, the lode which is being worked at the Barnum being a continuation of the north branch of the triangle which has its base on the Lake Superior property. The south wing of this lode is known to exist some distance—a half mile or more—beyond the present opening, but no active preparations have been made to work it.

The open pits of the hard ore mine of the Lake Superior company are worked down to a depth of 100 feet, at which depth drifts or tunnels, form communication between a pit at the base, and pits in the wings, there being a formation of rock left standing between the pits which would not yield enough ore to pay for removing it.

This constitutes the work, down to the open level, at a depth of 100 feet from the surface. There are skip roads, and bucket elevators, to take the ore out of the different quarters of the mine, but there is a main shaft, located directly upon the heel of the triangle, to which the bulk of the ore is intended to be fed for elevation, and which does the most of the work. This shaft is now down 150 feet, and forms the main communication with a level 50 feet below the open mine.

This 150-foot shaft leads to the lower level of the mine, from which drifts have been made, in three directions, with a view of connecting by means of winzes, to form stoping faces. One of these drifts runs out into the north wing of the vein a distance of 125 feet, and communicates with the open level above by means of a shaft. Another of these drifts runs off directly into the south wing of the vein nearly 100 feet, and is to be connected with the upper level by a winze. And a third runs directly south, at nearly right angles across the vein, a distance of sixty feet, and turning at right angles, is to be connected with a winze now down from the open level.

A Burleigh drill is now at work in this connecting drift, and in a few days the passage will be completed.

The best feature about these drifts on the lower, or 150-foot level, is, that they are *through ore*, showing the mine to be better at this depth than it was on the 100-foot level; and thus, the most important part of the undergrounnd work being completed, the production of ore in any quantity, is but a matter of labor.

Test pits on the south wing of this formation show a continuation of the vein to about the same magnitude that the north wing has been de-

veloped by the Barnum, with the only difference that there is not strong indications of as much slate ore.

SECTION SIXTEEN MINE.

This mine, about one and-a-half miles south-west of the Lake Superior, and being worked by this company, is loccted in a swamp, and consists of a single opening 60 feet deep in specular ore and rock, with a skip road, pump and engine. It does not appear promising, yet several thousand tons of ore have been taken out at a good profit.

THE PARSONS MINE,

Within gun-shot and west of "sixteen," is a bed of soft slate ore, lying in mass, which though lean, will probably be worked to advantage after a time. It has always been considered a fair ore property, but before coming under the immediate jurisdiction of this company did not promise especially favorable results. Stripping is being done and cuts are excavating preparatory to the vigorous mining of ore.

SECTION TWENTY-ONE MINE.

This mine is one of the well-known hematite openings on the Winthrop and New England range, adjoining the New England, and has been very productive of the best of soft ore. Capt. Curry, who has charge of this work, is making strong preparation to operate it to a large capacity during the coming season. Stripping, cutting and grading is being done in such manner as to take out all the ore which adjoins the New England, and afterward work deeper into the mine.

A narrow vein of fine slate ore, west of the New England, is being worked by Capt. Curry, which will yield several hundred tons at a trifling expense.

Further west on sections 19 and 28, is a very

PROLIFIC MINE

Of specular, soft hematite and slate ores, on the same range and adjoining the Saginaw. The developments are not as yet extensive, but no doubts are entertained as to the existence of large deposits of these ores in parallel veins. A dozen or more houses have been erected on the location, and facilities for mining are being introduced as rapidly as prudence suggests.

—Among the auxilliaries for mining which have been lately adopted by this company at the Ishpeming mine, is the Burleigh drill, one of which is in use on the 150-foot level, and four others are being gotten in readiness. The compressor is located in the engine house close by the main shaft, and so far the apparatus works very satisfactory.

—All the mines of this company are still under the efficient management of Capt. Johnson. No changes have been made in the officers or board of managers.

The following is a statement of the product of this company up to the close of 1872:

Year.	Gross tons.
1858	4,685
1859	24,668
1860	33,015
1861	25,195
1862	37,709
1863	78,976
1864	86,773
1865	50,201
1866	68,002
1867	119,935
1868	105,745
1869	131,343
1870	166,582
1871	158,047
1872	185,070
Grand total	1,275,919

PITTSBURGH AND LAKE ANGELINE IRON COMPANY.

THE LAKE ANGELINE MINE,

Belonging to this company, has been worked very prosperously since our last review, but does not present any especially interesting features. The whole opening, east and west, running almost parallel with Lake Angeline, is now 680 feet long, the east end yielding a very fine sixty per cent. specular ore, which continues to be found free of sulphur and phosphorus, while 120 feet of the west end is worked in a soft hematite, which dips, so far as it has been taken out, under the hard ore, the latter appearing to have overlapped the former at an angle of about 50 deg. This hematite is covered by about 25 feet of earth, and test pits on the west show that it runs off considerable distance in that direction. The vein of hard ore maintains an average width of 20 feet, as it is worked deeper, except at the east end of the vein, where it gradually narrows as if running off to a termination. On the north side of the vein spurs of ore of considerable width extend into the wall at right angles with the vein.

The facilities for working the mine consist of a pump shaft, 60 feet deep, which drains the whole mine, and is located about the centre of the opening. The engine operating this pump also transmits power from a hoisting drum to a derrick for hoisting ore from the east end of the mine. Another engine, supplied with steam from the boiler used for the pump, operates a friction-gear hoisting machine of a new pattern lately put up, in such manner as to easily raise a ton of ore every four minutes. For this purpose buckets are used, on separate derricks, one derrick 100 feet and the other 150 feet from the drum. The apparatus operates very effectually, and is far better than any of the clumsy machinery in use for the same purpose.

The shipments from this mine of both qualities of ore, for 1875, were 35,221 tons.

—On the south side of a high bluff which forms the footwall of the Lake Angeline mine, and a thousand feet or more distant, is the deposit of rich soft dark red hematite to which we referred in mentioning the Section Eighteen Cliffs mine. This lies in such abundance, and is in every way so easily handled, that the company think they will be able to take out not less than 20,000 tons of it during the coming season.

—A railway connection is to be made with the south side of this bluff, around its crescent on the west, to connect with the main line, where the Lake Angeline mine ores have hitherto been shipped. This connection will of course also be used by the Cliffs Company.

THE EDWARDS MINE.

This mine continues to be worked by the Pittsburgh and Lake Angeline Company, and is proving quite as satisfactory as it has been difficult to work. The ores are magnetic and hematite—a crystalline black oxyde, and a red oxyde, or slate.

As the openings first began so they continue, the four pockets so far worked lying like oblong boulders, the points overlapping each other with walls of talcose slate between nearly as heavy as the ore. The deposit of ore dips north and west, the angle to the west being so sharp that a shaft started from the surface of the centre of No. 2 pocket would strike the ore of No. 3 pocket on the fifth level, at a depth of 300 feet. With walls hanging at this angle some idea can be formed of the time consumed and expense attending operations in this mine.

The pump and skip shaft of No. 3 pocket is now down to the fifth level, 300 feet, with a winze on each side from the fourth level. Connections have been made between the shaft and these winzes, and stoping commenced both ways on 60-foot faces of ore. On the west end of the pocket a large wall of rock has been encountered, between the third and fourth level, and a drift was run back through this wall, on the bottom of the fourth level, and a winze put down from the third level behind the wall to connect, so that another face of 60 feet is ready to stope in that direction.

The skip and pump shaft of No. 2 pocket is down to the fifth level, 300 feet, and a drift has been made extending 60 feet westerly on the bottom of this level, connecting by means of a 40-foot winze with the fourth level, making 40-foot faces of ore to work on. The water in this shaft is raised to the second level, where it is conducted on the old working intervening between Nos. 2 and 3 pockets to No. 3, from whence it is elevated to the surface.

It will thus be seen, that notwithstanding the large quantity of ore which has heretofore been taken out of this mine, it seems but now ready to yield up its iron treasure. A year or more has been spent in

working the shafts and drifts in such form as to expose the ore in good working faces, and the coming season, as well as most of the time during the winter, ore can be handled without the interference of rock.

The American Iron Works, Pittsburgh—Jones, Laughlin & Co.—the largest rolling mill and nail factory in the United States, owning also two blast furnaces—are large patrons of this ore, as also the ore of the Lake Angeline, Mr. Laughlin being one of the Pittsburgh and Lake Angeline Iron Company.

The product of the Edwards mine this year was 28,380 tons. The product of the company to date, including the ore taken out of their Iron Mountain mine before it was abandoned, for the time being, is as follows:

IRON MOUNTAIN MINE.

1865—1868	16,594	16,594

EDWARDS MINE.

1866—1870	68,514	
1871	26,437	
1872	28,380	123,331

LAKE ANGELINE.

1864—1870	226,881	
1871	33,645	
1872	35,221	295,747
Total		435,672

Mr. A. Kidder, one of the most intelligent and industrious of all the mining agents, still has charge of these mines, as agent at Marquette.

THE KLOMAN MINE.

This mine is located on the west side of the Menominee river, in a latitude a trifle north of the Republic, on the opposite side of the river. The property was purchased late last season by Jonathan Warner, Esq., of Mineral Ridge, Ohio, Andrew Kloman, Esq., of Pittsburgh, and others, and is understood to have been purchased partly in the interest of the Lucy Furnace, Pittsburgh. The work so far done on the property exposes a fine bed of hard slate ore, which has been traced over a width of 40 feet, and over a length which cannot be definitely stated, though there seems to be a lead of not less than 200 feet on the top of the vein. The parties in charge are so sanguine of having a good bed of ore that they have resolved to continue stripping, and make all other preparation necessary to be ready to take out a large amount of ore, without interruption, as soon as railway facilities are supplied to ship the ore from the mine.

These railway facilities will constitute, as we have before mentioned, a branch of the Marquette, Houghton & Ontonagon Railroad, by way of the Republic mine, or a continuation of their present track on the south

and west side of Michigammi Lake, via the Magnetic mine, and down the west side of the Menominee.

THE WASHINGTON IRON COMPANY.

The system adopted for the operation of the Washington mine, at the commencement of 1872, is being carried out, so far, very satisfactory. The geology of the mine is very peculiar, and it has hitherto been quite difficult to determine where or how the most effective blows could be struck. The deposit is very heavy, with an incline to the north and west, but is pocketed in such irregular form, with heavy walls of talcose slate between, that until the openings were sufficiently extensive to designate the prominence of the deposits, there seemed to be no means of determining how the work could be carried on to advantage.

It will be remembered that this mine is worked by a tunnel, which was driven in from the base of the elevation in which the mine is located, about 500 feet from the first shaft put down, the surface of the hill varying from 50 to 150 feet above the tunnel level.

Commencing on the east of the main deposit, we find added to the work of previous years, the skip shaft, known as No. 1, down 100 feet below the third or tunnel level. A winze was put down on the third level near this shaft and a 40-foot stope opened, which is to be worked back 70 feet west to shaft No 2, the extremes being now connected by a drift.

At No. 2 shaft a Burleigh drill is at work driving the drift 150 feet to connect with shaft no 4. This drift is also to be carried to No. 5. shaft, 120 feet further west. No 4 shaft is down to within 22 feet of the drift level. At this point the deposit of ore is from 20 to 60 feet wide, intervened by a horse of mixed ore and rock. When the shaft has reached the drift level this deposit can be worked on a 40-foot face over a distance of 100 feet.

The extent of the deposit at No. 5 shaft cannot be stated to a certainty The drill was put down into 17 feet of good black and slate ores. The shaft at its present depth is in ore, but its bottom is yet 60 feet above the drift level, following the dip of the ore.

This drift level is to be extended still further west to investigate the deposits which are thought to lie there.

Considerable work was done during the past season on stopes above the tunnel level, where considerable ore is obtained and in bridging and strengthening the bridges which span the openings below this level for the extension of the tunnel westward.

A drift started some weeks since in what was supposed to be the hanging wall of the main deposit, has shown, after passing through 8 feet of rock, parallel veins of magnetic and slate ores, 3 and 6 feet thick respectively, and continues to show a good slate ore, with fair indications of a body of ore lying beyond. It is intended to work this discovery vigorously.

The work at Nos. 9 and 10, on the west, is being pursued as fast as prudence will allow. At No. 10 from four to five hundred tons of ore per month can be taken out. Explorations on the south of the old work on the hill, have shown good deposits of magnetic and slate ores, of the same grade taken from the old mine, which can be worked to good advantage whenever it may seem practical.

The working improvements for the season have been substantial and permanent. They consist principally of hoisting machinery applied to the principal skip shaft, and a skip road, which supplies the tunnel, from below, with more than half the product the tunnel takes out, an engine for the same, and a Burleigh rock drill.

A new store and some new dwellings have been erected. Everything about the mine, and in all the departments of its business, seem to be in the best working order, under the general supervision of Mr. St. Clair.

The following is the product of the mine up to the end of the yea 1872:

	Gross Tons.
1865	4,782
1866	15,150
1867	25,440
1868	35,757
1869	58,462
1870	79,762
1871	48,725
1872	38,841
Total	216,924

THE KEYSTONE MINE.

Proper embraces a tract of forty acres, in Section 32, Town 48, Range 29, a short distance east of the Champion, and on the same range. The land was originally entered by J. W. Edwards, Esq., and by him sold to Edwin Parsons, Esq., for the nominal sum of $300. In the summer of 1868 an opening was made in what appeared to be a narrow vein of magnetic ore, near the east line of the forty, from which about 2,000 tons were mined and shipped. The ore was found to contain a considerable trace of sulphur, however, and the opening was abandoned, until in the fall of 1872, Mr. Ely, as the agent of Mr. Parsons, sold the tract to Messrs. Swineford & Spalding, who succeeded in interesting some Ohio and Pennsylvania parties with them in the development of the property. A company was accordingly organized with a capital stock of $500,000, divided into 20,000 shares, with the following officers:

President—Geo. C. Reis, Newcastle, Pa.

Vice President—John Spalding, Cleveland, Ohio.

Secretary & Treas.—Joseph G. Butler, jr., Youngstown, Ohio.

General Agent—A. P. Swineford, Marquette, Mich.

Directors—George C. Reis, John Spalding, Chauncey H. Andrews, Joseph G. Butler, jr., and A. P. Swineford.

Work was commenced during the last week in November, with Capt John Sweeney in charge of mining operations, and within a week after a vein of very fine slate ore was struck, and exposed for a distance of nearly if not quite fifty feet in width. This ore was found about seventy-five feet west of the old magnetic opening, and is, doubtless, a part of the same vein metamorphosed. The ore is of the red specular variety, very rich in metallic iron, with no mixture of rock or other deleterious substance. Close observers are not able to distinguish any difference between it and the slate ores of the Republic mine, though the latter is some eight or ten miles distant from the Keystone.

Operations at the mine are now being carried forward with a view to a handsome product the coming season. A cut is being carried into the vein from the ravine in front of it, and the miners will doubtless reach the ore before the end of the present month. This cut will give a working face of about 30 feet, and will be carried through the vein, so that it can afterwards be worked in both directions. Another cut will be made about 300 feet to the west, where a still better face can be obtained. In the meantime the vein is being stripped of the surface, so that mining operations can be commenced as soon as the cut reaches the ore. The force will be increased as rapidly as circumstances will permit, there being at present about forty men on the pay roll. A boarding house, blacksmith shop, dry house and stables have been built, and we learn that another large boarding house will be contracted for immediately. The mine will be worked to the largest possible extent, and we think 25,000 tons a very safe estimate for the first year.

THE MICHIGAN IRON COMPANY'S MINES.

The Michigan mine, reported in our table of shipments, is what is generally known as the "Old Washington," but has for the past two years been worked under a lease by the Michigan Iron Company. But little work was done at this mine the past year, the product, most of which went to the company's furnaces, being less than 2,000 tons.

Recently, however, a new discovery has been made by Mr. Colwell, on section 7, Town 47, Range 28, about one mile south of the Clarksburgh furnaces, which promises the development of a most valuable mine. The ore is a very rich granular, similar to that of the Saginaw mine, and explorations already made prove certain the existence of a very large vein or deposit. A shaft has been sunk 27 feet in the ore, while the vein has been opened 17 feet from the hanging wall, without encountering the foot wall. How much wider the vein may be can only be determined by further work but enough has been done to warrant the company in making arrangements for the permanent working of the mine. A visit to the mine and a close inspection leads us to believe that the company have at last found that which they have long sought—a valuable mining property on their own lands.

THE REPUBLIC IRON CO.

The mine of this company is the famous Smith mountain, located on section 7, town 46, range 29, being a part of 1,327 acres of land owned by the company in the neighborhood of the mine.

The deposit of ore lies behind a quartzite rock which seems to form the bed of a small lake which lies on the north of Smith Mountain. The quartzite is the basin and margin of the lake, making a curve from north-east and south-west to the north, forming a crescent around the south base of the water-bed. The quartzite has a dip varying from ten to forty-five degrees, toward the north and west, or basin of the lake. Behind and beneath it lies the ore veins—first the black magnetic and then a slate ore, with sometimes an intermediate seam of slate or soap rock. Back of the ore is a diarite, a silicious schist, and a white granite, in regular order. This formation will be better understood as we describe the different openings which have been made in the ore beds.

The ore outcrops on the side of the hill, near its summit, like a composition which had been poured into a basin, and adhering to the side of the basin, another composition had been poured in and cooled upon the top of it, leaving the first not quite covered. This outcrop is at sufficient elevation to afford from 20 to 40 feet working face, and yet leave a working level sufficiently high to be used for the head of inclined tram roads to carry ore to the pockets, docks and stock piles at the point where it is loaded upon cars for shipment, near the margin of the lake.

HISTORY OF THE PROPERTY.

The discovery of this ore vein is accorded to Silas C. Smith, and by him entered in the land office. Subsequently, Edward Breitung, and others, became interested with him in its development, and in 1871 a company, composed principally of the following persons, was formed to operate it:

Jonathan Warner, Mineral Ridge, Ohio, President; Edward Breitung, Negaunee, Vice President; S. P. Ely, Marquette, Secretary and Treasurer; Peter Pascoe, Superintendent.

THE OPENINGS,

Are, so far, as follows:

No. 1 pit, beginning on the west extremity of the developments, at the foot or south end of the lake, or not far from the base of the crescent, opens very favorably. The ore lays back of the quartzite at a depth, or thickness, of 25 feet, with a working face of 80 feet, this being of the highest elevation of the ore above the railway track where the ore is received for shipment. At present, stoping is going on at an elevation above the railway track of about 20 feet, and the distance from the track to this opening is about 200 feet. It is intended, as soon as the pit is really ready for work, to make a cut for the railroad directly into the mine, and by this means fill the cars directly in the pits. This work may be done before the commencement of the coming season.

No. 2 pit has a 12-foot vein of slate ore directly behind the quartzite, the black ore seeming at this point to have found a lower level. The stripping is light, and the opening high enough to make the mine a mere quarry, from which the ore can be taken with the least effort. Test pits, which have been put down on both sides of this opening, confirm the belief that the vein is continuous, around the crescent, as all of the pits are down on the ore.

No. 3 pit is now stripping. A good face of ore is exposed, which will be taken out and delivered on the stock pile or docks by a double, or reciprocative incline. The pit is located on the south side of the elevation which, on all other parts of the location, seems to be the crown or south boundary of the ore veins. But in this instance the slate ore protrudes from the surface in mass, and is really the ridge-pole of the hill, A depression occurs a little west of the point where stripping is done, which will admit of an incline road being used to pass the ore to the shipping docks, on the north side of the bluff, in the manner mentioned. The slate ore in this pit is 40 feet wide, and there is a large quantity of mixed or second class slate running parallel with it.

No. 4 pit is located at the base, or origin, of the crescent. The ore veins here are 150 feet wide. The first or inner vein, which lies directly beneath a thin quartzite, is magnetic 30 feet wide. There is then a 5-foot vein of shale slate—then a narrow vein of magnetic ore—then another thin vein of shale slate—and behind and beneath these a broad vein of slate ore.

This looks like a mine which would yield an inexhaustable quantity of iron ore, and is practicably as good as many of the mines which are co sidered good enough within themselves.

No. 5 pit, within the north curve of the crescent, is characteristic of the formation, with the black, or magnetic ore foremost, and the slate in the rear, with quite hard slate rock intervening. A large quantity of ore has been taken from this opening. The system of incline tram roads, which it is intended to make general at these mines, is in use here, and the distance from the opening to the stock pile is but little over 500 feet.

No. 6 pit is 50 feet long and has a working face of 40 feet in height. Here the formation corresponds with that at other points. A shaft is now going down on one side of this pit, with a view of opening a 40-foot face lower down than the present working level. Ten feet is to be allowed for a slump for drainage.

No. 7 consists of an opening on the slate vein, some distance east of all the others, and at a point where the bluff rises considerably higher than in the rear of the other openings, yet the vein maintains about the same level. The vein has been traced by trenching some 250 feet, and is of a magnificent quality of ore. A shaft is going down on the vein, which is to be sunk 75 feet, and a tunnel is being driven 250 feet, from near the base of the hill, to connect with the shaft, and thus work into the vein right and left. The formation is almost perpendicular, on this

part of the property, and the ore taken out cleaves almost as easily as shingle blocks, and hence no better deposit could be found to work economically.

The whole space now occupied by these several openings is 2,000 feet in length, every foot of which seems to be a part of the ledge or veins which have so far been struck when looked for.

It is more than likely that before the tunnel is completed to the shaft the black ore will be encountered, placed as it has been found in the other openings.

Explorations which have been made north-east of this opening, show a continuation of these veins of rich black and slate ores, while above them a leaner, second-class ore forms the bare face of the mountain.

—Work has been going on at this mine but about a year. The time last winter was spent in surveys and test-pitting. A saw-mill was erected, supplies had to be taken in, nine miles over a new wagon road. A railroad had to be constructed—by the M., H. & O. company—and all the work commenced in the most primative style. Yet, on the second of October last, a train of ore cars was dispatched from the mine. Docks, tramways, pockets &c., had been constructed, and the mine was full-fledged for business:

Now there are thirteen houses on the location, a company store, a drug store, commodious barns, &c.

The shipping facilities are being so extended as to have a tram road from each opening to the railway, and the accommodations for loading from the docks and pockets will be such as to enable the laborers to handle twenty cars at the same time.

In short it is intended to handle a thousand tons of ore every day during the shipping season of 1873.

The buildings are of a better class than those erected by any other mining company in the Marquette district, and considerably better than those in use by many of the old companies. During the present year a school house and church will be erected, and every effort made to care for the positive as well as the temporal interest of the operatives.

THE BREEN AND INGALLS MINES.

These are the first attempts made to open the Menominee iron range. The mines are located southwest of Escanaba, one 32 and the other 44 miles. There seems to be a determination to open this region as soon as possible, and the two enterprises now in hand are under good management and in a tolerable forward state of development.

IRON MOUNTAIN MINE.

This mine which has been lying idle for several years, has been leased by Messrs. A. G. Clark and H. J. Colwell, who will resume operations early in the spring. The property is a valuable one, but we do not deem it necessary to go into a detailed description of it at present, inasmuch

as a complete history of the mine as it stands will be found in the book to which this review will be an appendix.

FURNACES.

THE MARQUETTE AND PACIFIC ROLLING MILL AND FURNACE.

The product of this establishment for the year 1872 was 4,332 tons of pig iron, and 622 tons of muck bar. Toward the close of the season an interruption occurred in the working of the furnace, which caused a chill, when the company determined to reconstruct it. The work has accordingly been engaged in, upon plans furnished by Henry King, the builder of Grace furnace, Marquette. The rolling mill equipment is of an indifferent character. The company may conclude to also improve this.

The amount of pig iron produced by this furnace, up to the close of the season of 1872, is 5,942 tons.

THE CARP FURNACE.

This enterprise was inaugurated in September last, by John Burt, Esq. who commenced building a 9-foot charcoal furnace, stone stack, at the mouth of the Carp river, a short distance below Marquette. The plan embraces the possession of several thousand acres of land, for charcoal and lumber purposes, a saw mill, a fine quarry of brown stone, and the furnace, with manufacturing establishments which are to embrace the production of bolts, nuts and spikes, and wire and wire rope. A short time since a company was incorporated for this purpose, to be known as the Carp Iron Company, with a capital of $500,000.

The fuanace is now well forward and nearly ready for its machinery. Coal kilns have been erected within a few rods of the furnace, and the prospects now seem to be that iron will be made early in the spring of 1873.

BAY FURNACE.

The quantity of iron produced at the Bay furnace last year was 4,900 tons, 4,339 tons of which were shipped.

A second stack was built during the season, and went into blast on the 1st of December. It is an iron shell, on columns, 10 feet in the boshes, and 46 feet high—the same size as No. 1. It is supplied with a steam hoist, as also a water hoist, either of which can be used, accord, ing to convenience. The boilers, blowers, and all the rest of the iron work of this furnace were made at the Bay foundry, Marquette, being the first furnace built entirely in this district—and it is regarded as good work in every particular.

Twenty-two new coal kilns were built to add sufficient supply of fuel for No. 2. About 4,700 tons of ore is on the docks for the joint use of both furnaces during the winter.

The shipping accommodations are very good, there being a dock 1,000 feet long, with a front of 400 feet on 11½ feet of water, which is not

disturbed by rough weather, except in cases of the most severe nor'-westers.

The company own 20,000 acres of land in the neighborhood of the furnaces, on Grand Island Bay, which is valuable alike for its timber, for coal and lumber. A State road has been worked toward Marquette-which will be completed the coming season. The distance is 40 miles.

The following is the product of this location:

Year.	Tons.
1871	3,597
1872	4,900
Total,	8,497

The officers and management of the company remain as before.

THE IRON CLIFFS FURNACES.

The product of these (better known as the Pioneer) furnaces, for the year 1872, was 6,985 tons. Up to this season both stacks were blown by the same engine and blower, but experience showed, as it always does in such cases, that the plan is not a reliable one, however well the valves and cut-offs may be arranged to divide the blast. Accordingly, No. 2 stack was blown out and supplied with a new lining, while a horizontal blower and engine was set up for this stack alone. After the repairs had been made—embracing some details in addition to the blower—and the blast was put on, the most gratifying results were obtained, the casts averaging 22 tons per day, which must be acknowledged a good yield for 9-foot boshes. No. 1 is now undergoing some repairs, which, it is hoped, will bring her work up to No. 2.

The total product of these furnaces is as follows:

Year.	Tons.
1858—1869,	43,566
1870	5,853
1871	8,193
1872	6,985
Total	51,617

Reference to the Cliff furnace at the Foster mine, has been made elsewhere in this review.

THE NORTHERN IRON COMPANY,

Whose furnace is located at Chocolay, three miles below Marquette, at at the mouth of Chocolay creek, have not been at work since May, 1867, up to which time, within the seven years previous, they had made 15,000 tons of charcoal iron. But during the latter part of last season the work of changing the furnace and adapting it to the use of anthracite fuel was commenced, and up to this time has reached a point which promises an early "blowing in" under the most promising circumstances. Capt. L. D. Harvey, the superintendent in charge, is an experienced iron manufacturer, and is determined to bring up this furnace to a standard second to none. The blowing machinery is in good condi-

tion, the stack is being relined and will be supplied with a modern waste chimney, the boilers are being overhauled, and a new and larger hot blast is being put in, which together with other repairs which are being made, will put the work in first rate running order.

There is a good harbor at the mouth of the Chocolay, for the receipt of stock by water, or the shipment of iron, and there seems to be no reason why this furnace cannot be made to yield a handsome tonnage of product.

THE BANCROFT FURNACE.

The product of this furnace for 1872 amounted to 4,250 tons, 4,006 tons of which were shipped.

In the fall of 1871, this furnace was rebuilt, and a 20-foot turret of iron put on the top. A new casting and top-house was also constructed, the hot blast enlarged, and a new lining and hearth put into the stack, so that her product was increased 400 tons over any former year. She was very carefully managed, and will do still better, as the company have purchased considerable additional wood land, and added eight 45-cord charcoal kilns to their coal capacity, to avoid the contingency, which too often occurs, of being short of fuel.

The officers of the Bancroft Iron Company are now as follows: Peter White, Marquette, President; Samuel L. Mather, Cleveland, O., Treasurer; J. C. Morse, Marquette, Secretary and manager.

We sum up the product of the furnace, as follows:

1861—1870	30,150
1871	3,850
1872	4,250
Total	38,250

THE JACKSON FURNACES.

Why the Jackson Iron Company, proprietors of the Jackson mines, should want to have their furnaces located more than one hundred miles distant from their mines, can only be explained from the fact that charcoal timber is far more abundant in the furnace locality than nearer the mines. These furnaces—like the mines of the company—are conducted in the most systematic and thorough manner. They are located at Fayette, Delta county—not exactly in the Marquette region, but are usually referred to as an offspring of the labor of Marquette district—25 miles east of Escanaba, and are under the immediate management of C. L. Rhodes, than whom, as is well known, there is not a more reliable manager.

We have the following report, from these furnaces, which we give in detail, for the benefit of all interested.

From Dec. 1871 to Nov. 30, 1872, the work of the furnaces at this place was as follows:

Iron made	10,090 1820-2240 tons
Ores used	15,643 1110-2240 tons
Coal used	1,126.771 bushels.
Yield of ore	64.56 per cent.
Coal per ton of iron	111.66 bushels.

But for lack of coal considerable more iron would have been produced. During the year ten new kilns have been built, and more will be built next spring, which it is hoped will furnish an ample supply of coal.

No. 1 stack is undergoing repairs. No. 2 is on its sixth week. You are aware that the first week is not, generally, very productive. This stack only made during that week 141 tons.

The amount of iron made at these furnaces, up to Nov. 30th, 1872, is as follows:

1868—1870	15,466
1871	9,140
1872	10,080
Total	34,686

THE MORGAN IRON COMPANY'S FURNACES.

The product of these furnaces for the year 1872 was as follows:

	Tons.
Morgan	4,356
Champion	5,006
Total	9,362

—The Champion, located at Champion station, on the company's property, 32 miles from Marquette, ran without interruption during the season, except for a time in April, when new pipes were put in the hot blast. Some new coal kilns were added during the season, and all the working facilities put in the best condition. The furnace is now running uniformly at 18 tons per day, but some changes are in contemplation for the year 1873, which are expected to favor its operations still further. A side-track, affording better communication between the furnace and the main line of railroad, will be constructed, and possibly the hot blast may be enlarged, and a new top-house built.

—The Morgan, located at Morgan village, eight miles from Marquette, was obliged to "bank up" several times during the year, on account of the scarcity of coal. Additional kilns are to be built this season, to obviate this difficulty. The wood lands of the company have been well stripped in the neighborhood of the furnace, and the principal dependence for coal is now centered on lands some ten miles distant, which are reached by a tram road.

Important changes are now going on in the furnace. The stack is being supplied with a non-renewing hearth and lining. The hot blast

is to be taken down and located on a level with the hearth, and constructed on an enlarged plan, with 45 pipes, 8½ feet long, and an oven of much larger capacity.

The furnace, with these improvements, will be ready to go into blast about the 1st of February, when there will be not less than 125,000 bushels of coal on the banks, ready for the more extensive business which is proposed for this year.

—The experiments which have been going on at this furnace, with Mr Donkersley's rotary puddler, have been attended with the delays which are usual to such movements. The plan is intended to supply means of manufacturing merchant iron without reheating until it is ready to be reduced from blooms or ingots, and to supersede, in point of economy and ease of operation, the Danks' process. In short, Mr. Donkersley proposes to complete merchant iron, under the rolls or hammer, without losing the virgin heat of the furnace, and to this end has provided reservoirs to receive the iron from the blast furnace and transmit it to the puddler, from whence, after being subjected to the influence of a heat produced by the combustion of pulverized charcoal, (braize) which is introduced into the furnace with a blast from a rotary blower, the balls are submitted to a hammer or the rolls, and the work is completed. It is expected that reheating will be necessary in cases where the iron is bloomed, but this is intended to be done as soon as the blooms leave the hammer.

The premises are provided with all the machinery and fixtures needed for these experiments, except the rolls. Some excellent iron has been made in the puddler, of far better quality than is usually produced by any similar process, a portion of it being the best quality of wrought iron. Some changes are now being made in the driving machinery, coal pulverizers, &c., by which it is expected to materially improve the process.

THE ISHPEMING PEAT FURNACE.

The success of the work done at this establishment, during the past season, has not been as conducive as was hoped toward the gratification of those who are engaged to adapting peat to smelting purposes. The furnace was started early in the season, but did not prove a success. Some change was then made in the blast and the furnace was started again, when some two hundred tons of grey iron was produced, but it was found that the stack was too small to work effectually—too sensitive to be governed well in the use of a fuel the nature and action of which is comparatively new and unknown.

So the furnace was blown out, not because of conviction of failure, but to enlarge it and adapt it more completely to the conditions and circumstances in existence. It will be ready to go into blast again early in the season, and we trust with the best of results.

DEER LAKE FURNACE.

This furnace made 2,720 tons of neutral iron during the year 1872. Late in the summer the iron broke out through the arch, on the left side, under the tuyere, and set fire to the blowing house. The fire was soon communicated to the casting and top house and consumed them, leaving the premises a complete wreck, with nothing but the stone stack and hot blast remaining. With characteristic energy, Mr. C. H. Hall, the managing agent, commenced clearing away the *debris* before the flames had ceased to act upon the larger timbers, and having succeeded in drawing the charge without permitting a salamander, he had the buildings re-constructed and the furnace at work before the expiration of five weeks.

It is intended to blow out this furnace during the winter, and substitute an iron shell 47 feet high with 9-foot boshes. Brenneman & Ward, of the Sampson boiler works, Pittsburgh, are to supply the shell. Some other changes, of minor importance, are to be made, which it is expected will increase the capacity and efficiency of the furnace somewhat.

THE MUNISSING FURNACE.

This furnace produced during the year 2,500 tons of pig metal. Several improvements have been made on the premises, and we are informed that it is the intention of the company to avail themselves of every facility possible to secure its entire success.

THE COLLINS FURNACE.

The produce of this furnace for the year amounted to 3,431 tons, 2,830 tons being No. 1 iron. The furnace was out of blast several weeks on account of the absence of coal. It is more than likely that it will cease work altogether this season, by reason of the consumption of the fuel in its neighborhood.

THE MICHIGAN IRON CO'S FURNACES.

The Greenwood furnace made 4,212 tons of iron during the year. It was out of blast from Feb. 3d untill April 12, undergoing slight repairs, but ran with uniform satisfaction during the time while at work.

The Michigan furnace made 4,001 tons of iron during the year. She was stopped from Jan. 20th until Feb. 17th, to be supplied with a new hearth and for repairs to the hot blast. The operation is now very satisfactory, and it is expected that no further changes or repairs will be needed in this or the Greenwood during the coming season.

The company have erected a saw-mill near Greenwood, to supply material for building a plank road to their coal kilns, embracing those formerly in use, four that were erected during the past season, and others which are in contemplation. The whole distance from Green-

wood to the end of the plank road route is ten miles, and it is expected to have this road completed by the middle of the coming season

THE LAKE SUPERIOR COMPANY'S NEW FURNACE.

This splendid anthracite furnace, which went into blast in the middle of December, is one of the most complete in detail of any so far erected in this country, and by far the finest one in the Lake Superior iron district. It is thoroughly practical and substantial throughout, without the least superfluity in the way of ornament, or claptrap in the way of hobby or experiment, as has of late been too much the case with new furnaces; and yet every detail is complete, and every appliance so simplified that every movement in the operation of the furnace must be absolute and reliable.

It is located on the margin of the east side of Marquette bay, its site, together with the docks used for the reception and storage of fuel, occupying an area of about five acres. The water front of the property affords 2,000 feet of room for vessels, with an abundant depth of water and the best of dock improvements.

The work of construction above water level was commenced on the 10th of May last. The foundation for the stack was commenced on the bed rock, and carried up eleven feet six inches above water level to the hearth, leaving cells and a damp chamber beneath by which all moisture will be intercepted, and the difficulty which sometimes occurs through the drawing of water by the capillary attraction created by heat is entirely obviated.

The stack is an iron jacket, set on columns, lined with fire brick, 60 feet high, 17-foot boshes, and a 7-foot 6-inch hearth. It is provided with seven tuyeres, which, together with the blast pipes, are hung in stirrups and adjustable yokes, the L of the tuyere pipe being provided with a ball and socket joint, so that the entire apparatus will conform at all times to the action of contraction and expansion without opening the joints or being liable to derangement. The tuyeres are supplied with reducers, by which the volume of blast can be regulated without cutting off the pressure. This appliance consists of a series of rings which are made to fit in the nose of the tuyere, and which can be readily changed to suit the founder's requirements or the condition of the furnace. These rings, as well as the tuyeres, are finished perfectly smooth on the inside, so that the blast will be delivered to the stack in a solid volume, instead of being broken up, as is the case when it issues through an opening having ragged and irregular edges.

The furnace is provided with a bell and hopper top, and the waste chimney is carried up twelve feet above the top. The gas exit is an iron jacket lined with fire brick, and having an internal diameter of six feet. Its base rests upon a reservoir from which flues lead off to the hot blasts and to the boilers, the flues being provided with valves to

regulate the supply of gas and registers to regulate the supply of air. In this particular the appliances of the furnace are very complete to secure the most perfect combustion.

The hot blast is put up in two compartments, each compartment provided with a combustion chamber twenty-one feet long by five feet wide and six feet and six inches high, over which are laid in open space, with an arched wall and flame flues intervening, 720 feet of pipe of eight inches internal diameter and one and a half inches thick.

The premises occupied by the stack and hot blast and as a casting house are 50 by 130 feet, the casting floor being 50 by 68 feet.

The boilers are located parallel with the casting house. There are three in number, each 26 feet long by 42 inches in diameter, with two 16-inch return flues. They are placed in and surrounded by mason work, but the entire heating surface is exposed in one common chamber. Grate bars are provided for the temporary use of wood or coal, but the space in the rear of the bridge wall is left unfilled, thus affording all the space possible for the combustion of gas. The stack of the boiler furnace is 100 feet 6 inches high—so well elevated as to be above the influence of any wind which may surge over the bluff in the rear of the furnace.

Heaters are provided, with 180 feet of 2-inch pipe, and the water is passed into the boilers at almost a steam temperature.

The stock hoisting apparatus is operated by steam upon an entire new plan. There are two vertical steam cylinders of 10-inch bore, half the length of the elevation, provided with plungers, to which the hoisting cable is attached. This cable passes up to a shaft provided with two drums, one being a large one upon which the hoisting platform is suspended, and the other the power drum, by which the movement of the apparatus is effected; and the large one from which the platform is suspended being twice the diameter of the power drum or pulley, the platform is moved two feet while the plunger in the piston moves but one, and thus the platforms are alternately carried up and down.

Blast is furnished by a direct acting vertical blowing engine, with a blowing cylinder 7 feet in diameter and 4½ feet stroke, and a steam cylinder 34 inches in diameter and 4½ feet stroke. It is a massive yet compact and powerful piece of machinery. In the same apartment is the blast receiver, the water feeding tank, the heater and two steam pumps—one of the latter to serve the boilers and the other to serve the coolers around the tuyeres, but both fitted so as to be interchangeable and one to do the work of the other, or work together or separately.

The stock house is 76x100 feet, with posts 28 feet high. A railway trestle passes through it, with a turn table, from the bank in the rear of the furnace, where the ore is brought in from the M., H. & O. railroad. The fuel is received on the dock in front of the furnace and moved to the stock house in carts.

The iron foundations for two calcining kilns, each 20 tons capacity, have been put down in the rear of the stock house, where their

contents will be readily accessible with the other stock used, but these are not yet completed, and the furnace will be started without them. Space has been left for two others, should they be required.

The buildings, except the stock house, are constructed of Marquette sandstone and covered with iron roofing. The stock house is a wood and iron frame with iron roofing.

The premises are complete, roomy, and so arranged as to be most conveniently and economically operated, and there can be no doubt about their satisfactory and successful operation.

The Lake Superior Iron Company are the proprietors—Mr Henry King, of Pittsburgh, the superintendent of construction. The blowing machinery was furnished by Robinson, Rea & Co., Pittsburgh—the fire brick by Pendleton, Brother & Co., Rochester, Pa.—the stack and gas turrets by Brenneman & Ward, Pittsburgh—the boilers and a considerable quantity of light work by the Iron Bay Foundry, Marquette—and the stack columns and foundation segments by the M., H. & O railroad shops.

THE ESCANABA FURNACE.

This furnace is erected on a forty-acre plant about a mile and a half north of Escanaba, on the bay. It is the property of the Escanaba Furnace Company, comprising mainly Joseph Kirkpatrick, Andrew Kloman, Samuel Hartman, Samuel Riddle, William Smith, James Lyons and William Bagaley, of Pittsburgh, and who constitute the Cascade Iron Company. Work was commenced on the foundations early in the spring, and but for the difficulty of obtaining material, would now be fully completed and the furnace making iron.

The work is constructed after plans made by Wm. Tate, the builder of the Lucy, Isabella and Moorhead furnaces, Pittsburgh, and Mr. Kloman, and is as follows:

THE STACK.

It is a charcoal furnace with an iron stack lined with fire brick 56 feet high, 12 feet across the boshes, and four-foot hearth, set on columns, and surmounted by a bell and hopper top, with an exit chimney. The fannel of the bosh is encased in an iron jacket and pierced with three tuyere chambers, in which are to be fitted Taws & Hartman's Philadelphia cooling boxes and water coils. The base is surrounded by a water jacket, and within the foundation are damp chambers and air cells. The gas exit is two feet below the top of the stack, leading down an iron column lined with fire brick of six feet six inches internal diameter, to a reservoir from where gas is distributed to the hot blasts and boilers, and regulated by valves. The blast pipes and tuyeres are to be hung in stirrups, the tuyeres being provided with ball and socket L joint, to avoid the derangement of contraction and expansion. Water is to be supplied to the coolers by gravity from a tank at an elevation on the side of the stack.

The work of this entire structure is of the best character, substantial and complete in every particular. The stack is located in a casting house 71 by 78½ feet, the space given to it occupying one-half of the narrowest dimensions, the other half being set apart for a second stack to be erected hereafter, and for which the foundation is already constructed. It is a fine building of white brick, on broad foundation walls provided with water sheds, and surmounted by an iron roof of the most approved construction.

THE HOIST.

A pneumatic hoist is placed just outside of the casting house and between that and the stock house. It is of the Taws & Hartman pattern placed upon a foundation which has not only been built under the tube but is alike substantial and of the same degree of excellence under the derrick or guy frame which surrounds the tube and cages. The top of this hoist and the furnace top is reached by a spiral stairway which is wound around the gas stack. Provision is made to make this hoist do the work of both furnaces as soon as the second furnace has been erected.

THE HOT BLASTS.

These are two in number, for the furnace already erected, with foundation ready for the second set as soon as they may be required for the second furnace. These blast ovens are some 30 feet high, provided with a combustion chamber beneath, in the usual manner, surmounted by 24 12-inch pipes 14 feet high, and are calculated so that there will be abundant heating surface, with sufficient area of volume to give the furnace all the blast she will need under any circumstances, while there are valves placed so as to regulate the supply to suit the different conditions under which she may work.

THE STOCK HOUSE.

This is a building 60x100 feet, with a track for fuel on one side and a track for ore on the other, both being elevated at a sufficient height to admit of an easy passage beneath. Through the middle a trestle is constructed with a track over its longitudinal course for the movement of an ore crusher from one end of the house to the other. Beneath it there are pockets which take the ore as fast as it is crushed and hold it ready to be drawn off into the charging buggies. This building is also constructed of brick, in the most substantial manner, with an iron roof.

THE BOILER HOUSE.

The buildings are grouped in this form: $\equiv\,=$, the two parallels representing the casting and stock houses, with the hoist and hot blasts between, and the single parallel representing the boiler and the engine house, with a space between them and the casting house. The boiler house is 47 by 70 feet. It is provided with four cylinder boilers 50 feet

long by three feet six inches in diameter, each boiler setting in its now fire box, with grates eight feet long, and a two-foot bridge wall at the rear, with the spaces back of the bridges left open and paved. The heater is provided with 60 feet of two-inch pipe.

The boiler stack is an iron tube, lined with fire brick, 100 feet high, 10 feet internal diameter at the base and six feet at the top. It sets on a sandstone base 26 feet square, which finds its home 10 feet beneath the ground, and which is anchored and bound together by strong bolts, strongly secured at the bottom and passing up through the stone work are secured on a cap plate which covers the top of this foundation. The peak of the stack is ornamented with a ball swell, which corresponds in size with the base of the iron tube, and altogether it is one of the most substantial and symmetrical pieces of chimney workmanship to be found.

THE ENGINE ROOM.

This department is 33 by 37 feet, one-half of the space being now occupied by the engine set up for the present furnace, and the other half prepared for the reception of a second engine. The engine in place is a direct acting vertical machine, with steam cylinder 30 inches in diameter by 4 feet stroke and blowing cylinder 60 inches in diameter by 4 feet stroke. The blast receiver is 5 feet internal diameter and 150 feet in length, extending from the engine house, outside, past the boiler house to the rear of the stacks, between the stock and casting houses. The roof of this building is of iron, in octagonal form, surmounted by an octagon cupola and a weather vane.

MISCELLANEOUS.

The work on every part of this furnace is of the best character. It is intended to excel in this class of mechanism, and the results show so far, that the parties having the work in hand have not spared skill, labor or expense, in constructing a furnace which would be a monument of the enterprise and firm business determination of the builders.

Twenty-six coal kilns are now in operation, along the line of the Peninsula Branch railroad, to supply the work with fuel, and others are to follow as soon as the exigencies of the case demand.

The superintendent of the work is Jno. L. Agnew, a well known Lake Superior iron man, and the mechanical engineer is Lewis Williams, of Pittsburgh.

The engine is one from that well known firm of Macintosh, Hemphill & Co., Pittsburgh. Two were ordered to be forwarded at the same time, but they could not both be completed on account of the pressure of work in the factors' hands. Their efficient employees in the erection of the engine are W. W. Alexander, and E. Nicholson. M., H. & Co., also supplied the pneumatic hoist and tuyere cooling apparatus.

Dickson, March & Co., Pittsburgh, supplied the columns and fire fronts.

The furnace turrets, and iron beams and rafters and corrugated sheets for the roofing, were supplied by Jas. M. Riter, Esq., of Pittsburgh, and erected under the supervision of T. B. Riter.

The brick work was done under the supervision of Thos. Tate, a brother of Wm. Tate, the planner and builder of furnaces.

The following table exhibits in gross and net tons the amount of iron ore shipped from the Lake Superior mines during the season of 1872, together with its total value at $6 per ton, gross:

MINES.	Gross tons.	Net tons.	Value.
Jackson	118,842	133,103	$ 712,052
New York	68,950	77,224	413,700
Cleveland	152,607	170,919	914,442
Lake Superior	185,070	207,279	1,110,420
Champion	68,405	76,613	410,430
Lake Angeline	35,221	39,407	211,326
Barnum	38,381	42,992	230,186
Washington	38,841	43,506	233,046
Edwards	26,026	29,149	216,026
Saginaw	19,160	21,461	114,960
New England	17,465	19,560	104,790
Cascade	35,069	39,278	210,414
Silas C. Smith	13,445	15,058	80,670
McComber	24,153	27,051	144,918
Foster	18,139	20,316	108,834
Winthrop	14,239	15,946	85,434
Negaunee	6,897	7,725	41,382
Marquette	11,924	13,355	71,544
Republic	11,025	12,348	66,150
Marquette & Pacific Rolling Mill	6,772	7,583	40,632
Allen	8,707	9,751	52,242
Grand Central	9,925	11,616	59,950
Wilcox & Bagaley	4,426	4,957	26,556
Mather	2,288	2,512	13,368
Green Bay	7,633	8,548	45,798
Franklin	2,007	2,248	12,042
Albion	1,100	1,232	6,600
Pittsburgh & Lake Superior	1,160	1,298	6,960
Michigan	1,227	1,374	7,362
Quartz	718	804	4,308
Excelsior	756	846	4,536
Williams	447	555	2,688
Iron Cliffs Red Ore	545	610	3,270
Shenango	197	217	1,182
Pendill	127	142	762
Michigamme	141	158	846
Carr	18	21	108
Shelden	7	8	42
Total	952,055	1,066,297	$ 5,712,330

The following table exhibits the total product of the several furnaces for the year 1872, together with the value:

FURNACES.	Gross tons	Value.
Pioneer	6,985	$ 384,175
Collins	3,431	188,705
Michigan	4,001	220,055
Greenwood	4,212	231,660
Bancroft	4,250	233,750
Morgan	4,356	239,580
Champion	5,006	275,330
Deer Lake	2,720	149,600
Jackson	10,080	554,400
Schoolcraft	2,500	137,500
Bay	4,900	269,500
Marquette & Pacific Rolling Mill (Pig)	4,332	238,260
Marquette & Pacific Rolling Mill (Muck Bar)	622	49,760
Lake Superior Company's Peat Furnace	200	11,000
Total	63,195	$ 3,475,725

THE iron traffic for 1872, was divided between our two railways as follows:

IRON ORE.

Over M., H. & O. R. R.	454,912
Over C. & N. W. R. R.	488,686
Difference in favor of C. & N. W. R. R.	33,774

PIG IRON.

Over M., H. & O. R. R.	28,991
Over C. & N. W. R. R.	9,166
Difference in favor of M., H. & O. R. R.	19,825
Total ore and pig iron over C. & N. W. R. R.	497,852
Total ore and pig iron over M., H. & O. R. R.	483,903
Total shipments	981,755

With a difference of 13,949 tons in favor of the C. & N. W. R. R.

The following table exhibits in gross tons the total product of each mine from 1856 to 1872, inclusive:

Mines.	Gross Tons.
Jackson	1,197,225
Cleveland	1,025,261
Marquette	52,998
Lake Superior	1,275,919
New York	450,780
Lake Angeline	295,747
Edwards	121,077
Iron Mountain	16,594
Barnum	126,977
Foster	73,781
New England	108,809
Washington	308,919
Champion	234,867
Cascade	39,240
Grand Central	14,755
McComber	44,153
Parsons	1,896
Winthrop	25,027
Saginaw	19,160
Negaunee	11,687
Iron Cliffs red ore	874
S. C. Smith	13,445
Republic	11,025
M. & P. Rolling Mill	6,772
Allen	8,707
Wilcox & Bagaley	4,426
Mather	2,288
Green Bay	7,633
Franklin	2,007
Albion	1,100
Pittsburgh & Lake Superior	1,160
Michigan	1,227
Quartz	718
Excelsior	756
Williams	447
Shenango	197
Pendill	127
Michigamme	141
Carr	18
Harlow	83
Shelden	7
Total	5,567,373

The following table shows the total product of the Lake Superior furnaces from 1858 to 1872, inclusive:

Furnace.	Gross Tons
Pioneer	64,597
Northern	15,068
Collins	40,949
Michigan	27,345
Greenwood	29,352
Morgan	35,991
Bancroft	38,251
Champion	25,566
Jackson	34,242
Schoolcraft	10,057
Deer Lake	10,553
Bay	11,995
Marquette and Pacific (pig metal)	5,942
" " (muck bar and merchant iron)	999
Lake Superior Co's. Peat furnace	200
Total	357,880

The following is a statement in gross tons of the production of ore and pig iron in this district from 1856 to 1872, inclusive, together with the aggregate value:

YEAR.	Iron Ore.	Pig Iron.	Ore and Pig Iron.	Value.
1856	7,000	.....	7,000	$ 28,000
1857	21,000	.....	21,000	60,000
1858	31,035	1,629	32,661	249,202
1859	65,679	7,258	72,937	575,529
1860	116,908	5,660	122,658	736,496
1861	45,430	7,970	53,400	419,501
1862	115,721	8,590	124,311	984,977
1863	185,257	9,813	195,070	1,416,935
1864	235,123	13,832	248,955	1,867,215
1865	196,256	12,283	207,539	1,590,430
1866	296,972	18,437	315,309	2,405,960
1867	466,076	30,911	496,987	3,475,820
1868	507,813	38,246	546,059	3,992,413
1869	633,238	39,003	672,241	4,968,435
1870	856,471	49,298	904,319	6,300,170
1871	813,379	51,225	864,604	6,115,895
1872	952,055	63,195	1,015,250	9,188,055
Total	5,537,373	357,880	5,903,803	44,373,833